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SOME NOTES ON THE OPERATION OF THE POWER PLANT OF THE CHICAGO & MILWAUKEE ELECTRIC RAILWAY COMPANY

The satisfactory operation, during the past year, of the power generating and distributing system of the Chicago & Milwaukee Electric Railway, makes some of the unusual features which were adopted in this installation of greater interest to other roads which have difficulties calling for similar apparatus that they have been unwilling to install until it has been tried by pioneers. Among the unusual features of the Chicago & Milwaukee equipment at the time when it was laid out, although they have already

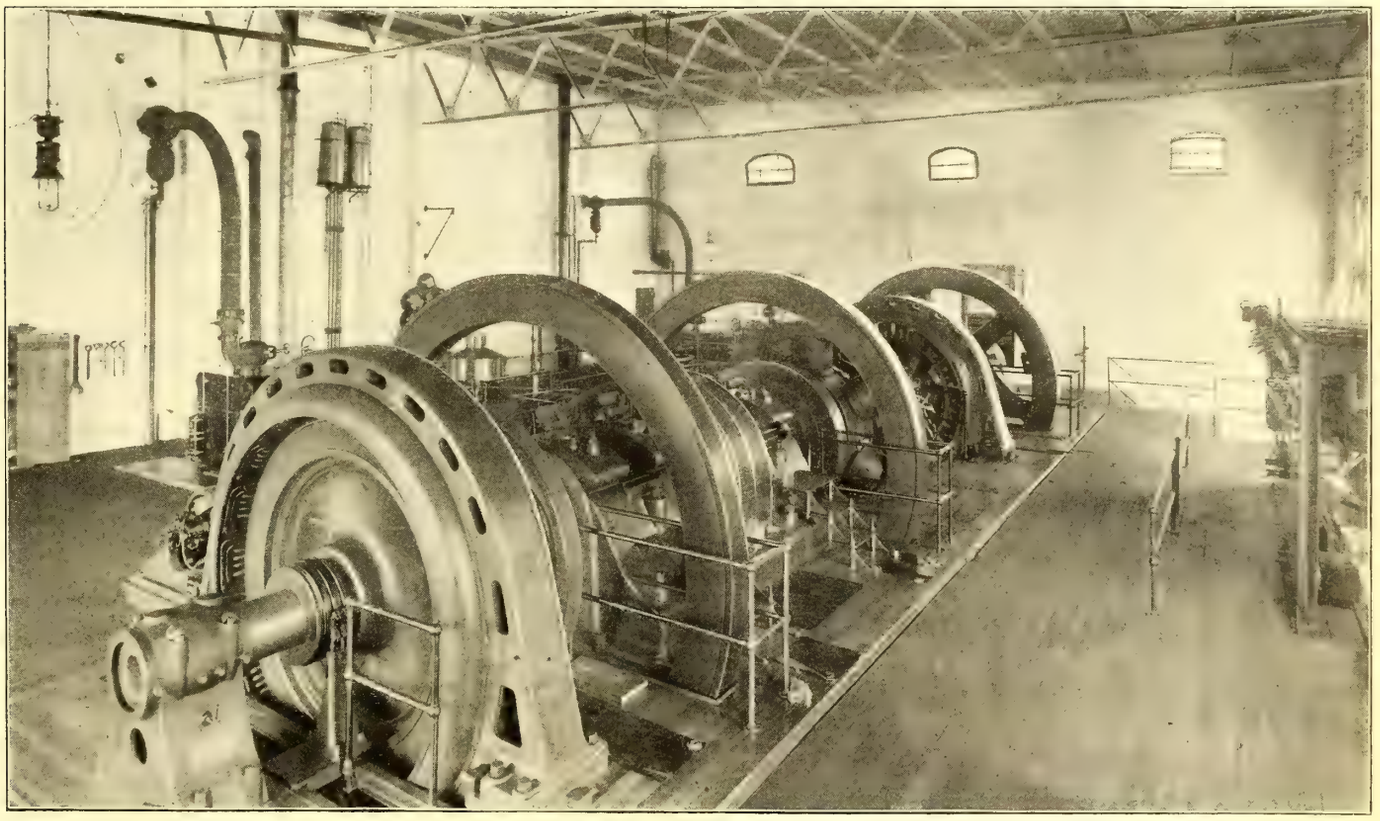


FIG. 1.—INTERIOR OF POWER STATION, CHICAGO AND MILWAUKEE ELECTRIC RAILWAY

come to be more nearly standard practice, are the following: First, a complete polyphase transmission system from the power station to sub-stations with rotary converters and storage batteries; second, the Arnold system of coupling several engines and generators to each other in any desired combination; third, the use of a cooling table for the condensers. The operation of these three features will be explained below in the reverse order to that in which they are here mentioned, the cooling table being taken up first.

There are in the power station at Highwood two Filer & Stowell tandem-compound horizontal engines of two sizes, in order to give at all times a load factor as high as possible with such a small number of engines. The exhaust steam from these engines is handled in two Deane jet condensers and independent air pumps. The station being inland, there is no opportunity for obtaining sufficient cold water for condensing purposes. A cooling pond of sufficient area to handle the exhaust steam output of this station would prove expensive in this location, and cooling towers would require a considerable amount of power for the operation of their blowers, if of the forced-draft type, and would be quite expensive if of the natural-draft type. On this account the consulting engineer, B. J. Arnold, decided to use a cooling table, this being virtually a small cooling pond, the surface of which is multiplied by causing the water to circulate over a number of wooden platforms, slightly inclined so as to cause a flow of the water from end to end of each. The arrangement of these parts is clearly indicated in the view of one end of the cooling table, Fig. 2, and the detail drawings shown in Fig. 3. In this case the number of platforms over which the water has to flow before it falls into the pond is three; the platforms being so inclined that the water flows back and forth over the whole surface of all of them in succession before falling into the pond, from which it is drawn by the condenser suction. The air is allowed to circulate freely between the

platforms, which are exposed so that the wind blows through and constantly carries off from them the water which evaporates. In this way the available surface for evaporation over a pond occupying a given space is greatly increased, making it possible to cool the condensing water of a large plant in a reasonable space without power-consuming auxiliaries or such expensive draft-producing towers as are necessary in a natural draft arrangement.

At the Highwood plant the pond itself is about 150 ft. x 60 ft. in size, banked or excavated to a depth of about 5 ft., a 13-in. brick wall being carried up from the banks to a height of about 2 ft., giving a basin about 7 ft. deep. This is floored by 4 ins. of stone concrete, the walls of the basin having sloping faces of stone concrete with a ⅜-in. cement

anticipated. With the usual load on the plant, which drives twenty motor cars, most of them long heavy interurban cars, and eighteen trailers, a vacuum of about 22 ins. is obtained in the summer, this running up to 24 or 26 ins. in the winter season. In ordinary weather the condenser discharge has a temperature of 115 or 120 degs., the water being returned at about 90 degs. F. The cylinder oil from the engines collects, as the illustration shows, in the corners of the pond, and can be drawn off and partially recovered, if desired. The evaporation from the pond is, of course, supplied by the addition of fresh feed water obtained from the town water supply, this feed water finding its way to the cooling pond through the jet condensers.

As noted above, the engines and generators are all set

FIG. 2.—COOLING TABLE AND POND

facing, as is clearly shown in the drawings. The table itself is not as large as the pond, being only 132 ft. in length by 31 ft. in width, the arrangement of its timbers and planking being clearly shown in the drawing. The outcoming hot water from the condensers discharges on a flaring incline, as shown in the photographic illustration, Fig. 2, being distributed the full width of the table by distribution boards, forming a sort of slotted dam. The table, of course, steams constantly when the plant is in operation, as the view indicates, but the steam is not found objectionable in any way either around the property of the railroad company at Highwood or the neighboring residence district, and is dissipated in the coldest weather without the formation of any ice on neighboring objects as might be

up with their shafts in one line and are provided with magnetic clutches for driving any desired one or more of the generators from either or both engines; this being probably the first railway plant in this country completely equipped with this system and its magnetic clutches, by means of which machines may be coupled or uncoupled while the apparatus is in motion. The general arrangement of the engines and generators is shown in the power house plan, Fig. 4. There are three generators, one a 250-kw direct-current machine designed to supply that part of the line which can be reached economically with direct current from the power house. The other two machines are 25-cycle three-phase alternators, each rated at the same power as the direct-current machine, or 250 kw. As will

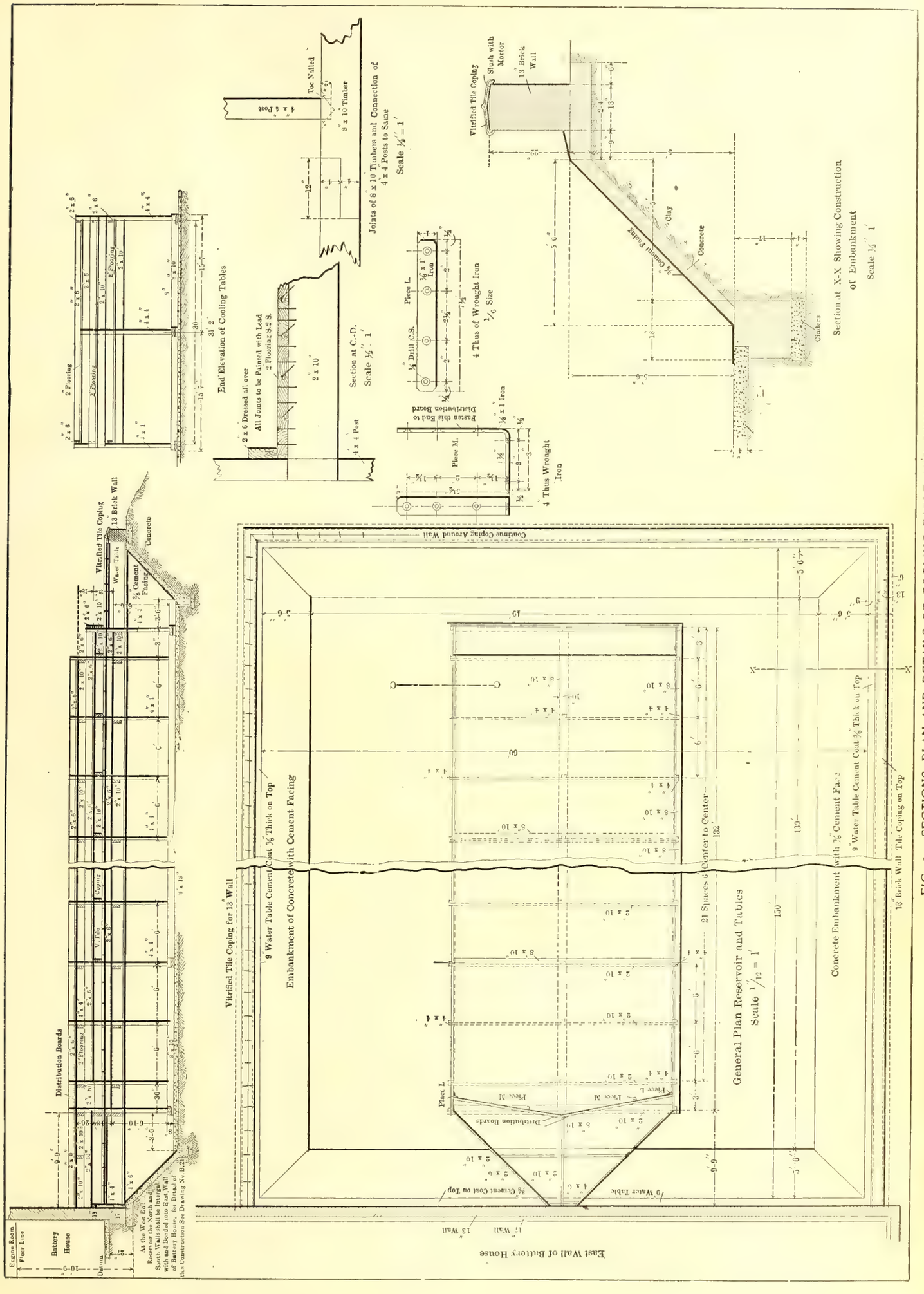

End Elevation of Cooling Tables
Section at C.-D.
Scale ½" = 1'
Joints of 8 x 10 Timbers and Connection of 4 x 4 Posts to Same
Scale ½" = 1'
Section at X-X Showing Construction of Embankment
Scale ½" = 1'
General Plan Reservoir and Tables
Scale 1"/12 = 1'
Vitrified Tile Coping for 13" Wall
9" Water Table Cement Coat ⅜" Thick on Top
Embankment of Concrete with Cement Facing
Concrete Embankment with ⅜" Cement Face
9" Water Table Cement Coat ⅜" Thick on Top
13" Brick Wall Tile Coping on Top
Distribution Boards
Battery House
Engine Room Floor Line
Datum
East Wall of Battery House
Clay
Concrete
Cinders
Vitrified Tile Coping
Slush with Mortar
13" Brick Wall
Water Table
⅜" Cement Facing
Coping
Piece L.
Piece M.
4 Thus of Wrought Iron 1/6 Size
4 Thus Wrought Iron
Fasten this End to Distribution Board
21 Spaces 6' Center to Center
132'
150'
139'
60'
19'

FIG. 3.—SECTIONS, PLAN AND DETAILS OF COOLING TABLE AND POND

be seen by the plan, and by the general view, Fig. 1, one of the alternators is mounted outside the larger engine, the other alternator and the direct-current machine being mounted between the larger engine, which is of the center-crank type, and the smaller engine, which is of the side-crank type and is located at one end of the line. The alternator located outside of the large engine can be driven from that engine alone, but either or both of the machines between the two engines can be driven from either or both of the engines, working either independently or coupled together. The arrangement of the shafts and couplings for accomplishing this purpose is shown more clearly in the section of that part of the shafting between the two engines, reproduced in Fig. 6. In this drawing it will be seen that the rotating parts of the two generators are mounted, not on the solid shaft itself, but on hollow shafts

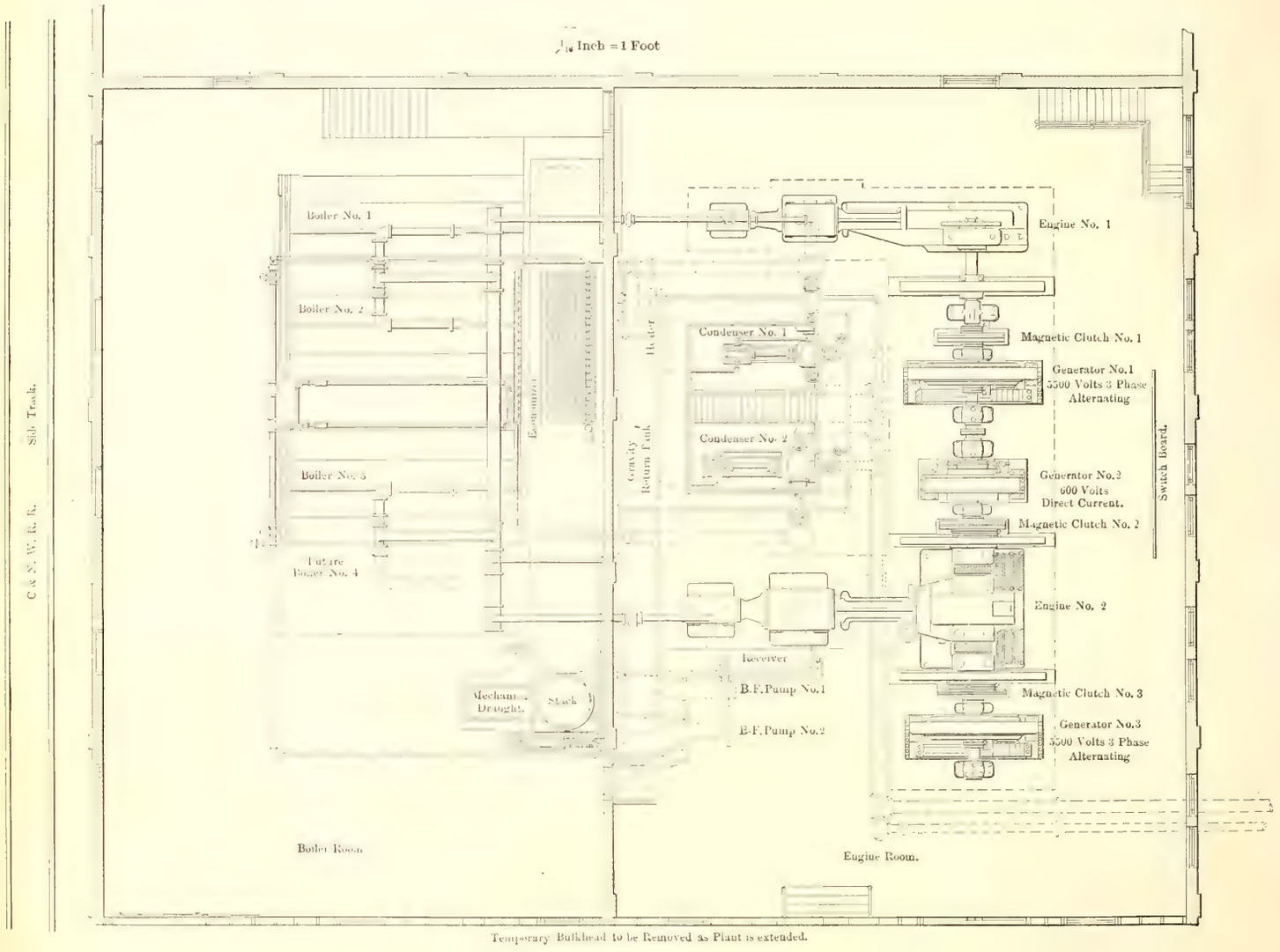


FIG. 4.—PLAN OF POWER STATION

together and thus join the dynamo quill to the engine shaft. By energizing two coils in one magnetic clutch the solid shaft, the quill and the engine shaft may be all clutched together if necessary. Thus, for example, by drawing together the two outer rims of the right-hand clutch, as shown in Fig. 6, the direct-current generator is connected to the large engine; by drawing over the central rim of the same clutch and by attaching the central rim of the left-hand clutch to the right-hand rim of the same clutch both generators are connected to the large engine. In a similar way either or both generators can be connected to the small engine, or one generator can be connected to each engine or both engines can be clutched together, driving either or both generators.

It will be noted that the central solid shaft is in two sections, fastened together at the center by an ordinary bolted flanged coupling, for convenience in erecting and repairing. This solid shaft runs in two shaft bearings immediately adjacent to the central coupling. When its ends are not clutched to the quill or engine shafts the greater part of the solid shaft overhangs its bearing. When its ends are not clutched in the magnetic clutches, however, the solid shaft is not rotating, so that the overhang is no disadvantage.

or quills surrounding the solid shaft. Each of these quills —one carrying the armature of the direct-current machine and the other the rotating field of the alternating-current machine—is supported in two quill bearings and carries on one end a disc of what is termed a "three-way magnetic clutch." Each of these three-way magnetic clutches has three sets of spokes and three rims; the central one is attached to the inner solid shaft, one of the outer rims is attached to the adjacent quill and the other to the adjacent engine shaft. Coils embedded in the rims and concentric with the shaft are arranged to draw the central rim toward either of the outer rims and thus clutch the solid shaft to either the quill or the engine shaft. Other coils are provided to draw the two outer rims of one magnetic clutch

The alternator at the extreme end of the system and outside of the larger engine is also connected to this engine through a magnetic clutch, but can be driven only by the large engine. It will be noted from the general view, Fig. 1, that this alternator is also mounted on a hollow quill,

so that when extensions are made to the system a solid shaft can be put through this alternator to connect it to the next engine in the line in the same way that the two other generators can now be connected to either engine.

By means of this system the failure of any one dynamo does not incapacitate either engine, nor does trouble with any engine throw out of service any dynamo, while failure of the larger engine only shuts down one alternator. The larger engine is sufficient in size to carry the usual load, and a reserve source of power is provided without using another engine of the same size by fitting the smaller engine with a by-pass in such a way that both its cylinders can be supplied from the boiler and exhausted into the condenser, a reducing valve being used in the connection to the low-pressure cylinder. In this way it will deliver enough power to run one alternator and the direct-current machine to carry the usual load on the power plant. There being only one direct-current generator, this is always kept in operation to feed the adjacent sections of track, although service could be continued in case of failure of this generator by feeding back from the sub-stations and by virtue of the storage battery at the power station. Normally the direct-current machine and one alternator are run by one engine, in case of light load by the small engine, and in case of heavy load by the large engine. At the time the photograph reproduced in Fig. 1 was taken, it will be seen that the large engine was in operation, driving the alternator at the left-hand end of the line and the direct-current machine. At any time the couplings may be changed so that the small engine at the right-hand end of the line may drive the alternator adjacent to it and the direct-current machine. There is no provision for bringing the generators up to speed by electrical means when the engines are running so that the generators can be started and coupled to the engines without stopping the latter, an arrangement which is in some cases provided with the Arnold system in lighting stations. If the load is sufficiently heavy to call for the operation of both the alternators at

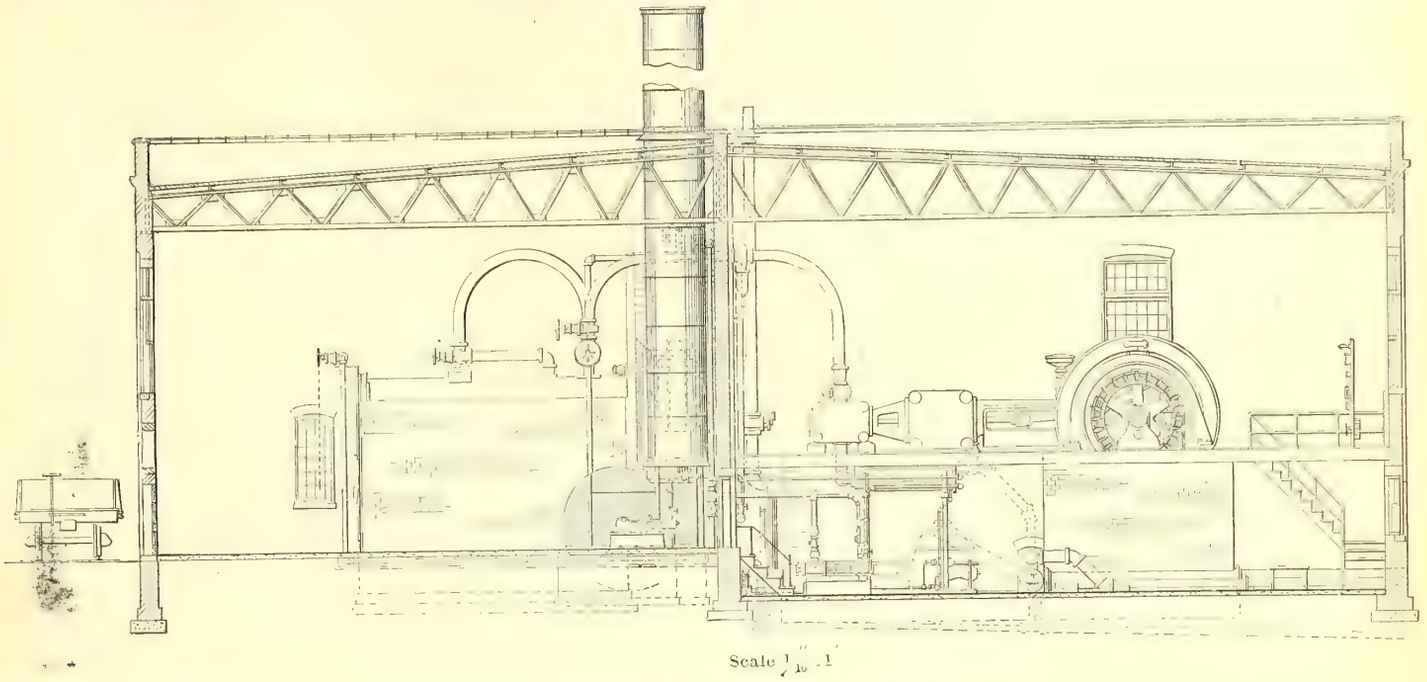


FIG. 5.—SECTION OF POWER STATION

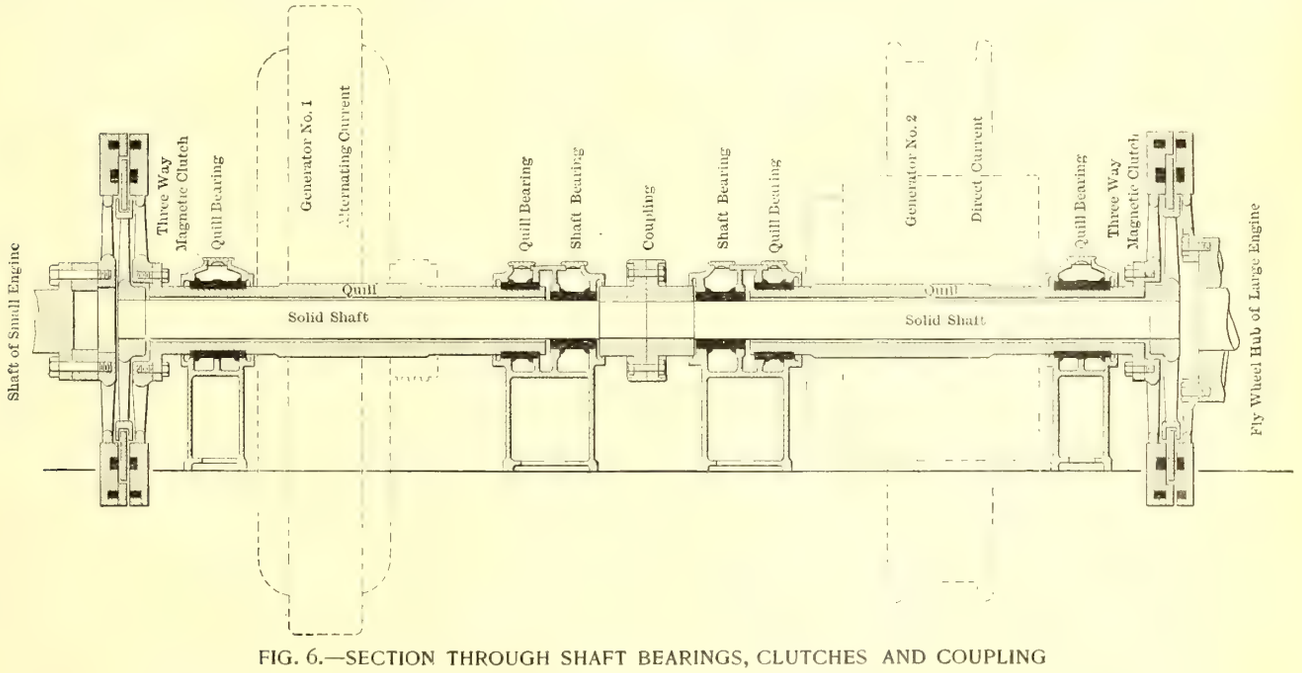


FIG. 6.—SECTION THROUGH SHAFT BEARINGS, CLUTCHES AND COUPLING

the same time they are generally driven from the two engines respectively, one alternator taking the load of one sub-station and the other taking the load of the other sub-station, so that they are not in parallel with each other. They can, however, be synchronized in the usual way and thrown in parallel, after which the clutches may be operated if desirable, so as to couple them mechanically to each other and drive them from the large or both engines. The fields of the alternators are supplied by exciters which are belted on the face of the magnetic clutches, as shown in Fig. 12, the belt covering only a portion of the surface so that it will not interfere with the operation of the parts.

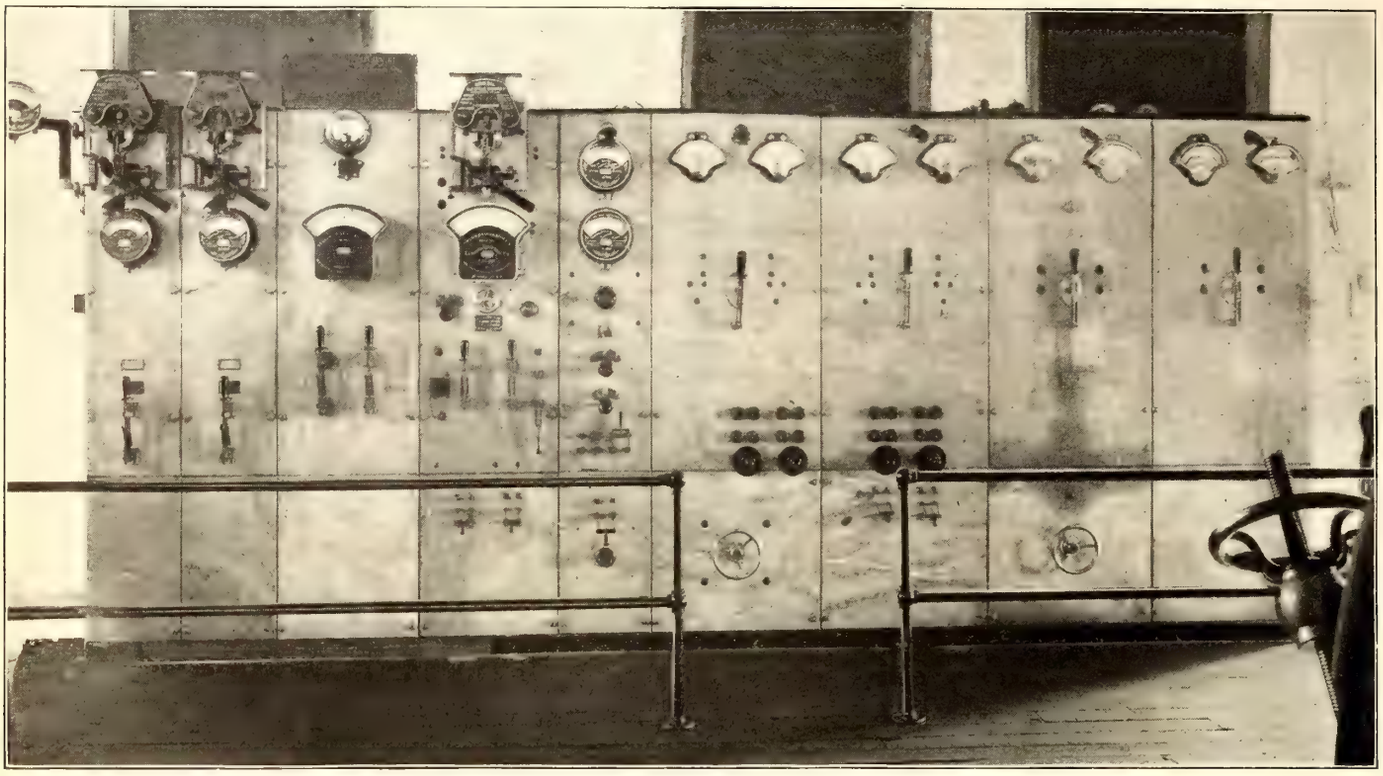


FIG. 8.—SWITCHBOARD AT MAIN STATION

FIG. 7.—CAR ON TRESTLE

THE ELECTRICAL CIRCUITS

The alternators deliver their output at full line pressure of 5500 volts, thus avoiding the necessity of any step-up transformers. There are no fuses in the circuits between the generators and the switchboard, spring-expulsion type fuses being used in the outgoing high-tension lines. The switchboard of the generating station, as shown in Fig. 8, is somewhat unusual on account of the combination of direct and alternating-current machinery. To the left are two ordinary direct-current feeder panels, next to which is a battery panel, and next to that a generator panel; the narrow panel is for the exciters, the remaining four panels being alternator and alternating-current line panels. The only notable feature about this board is the use of high-tension voltmeter receptacles and plugs, by means of which only one transformer per voltmeter is used instead of a transformer in each phase of each line to be measured, as is required when low-tension plugs and receptacles are made use of.

The overhead trolley line, 27

miles in length, is divided by section insulators into three sections, each about 9 miles in length. The middle section is supplied from the direct-current generator at the power station and each of the two end sections is supplied from a rotary-converter and storage-battery sub-station. The three sections are normally tied together electrically on the 600-volt lines so that they help each other. The two sub-stations are almost exactly like each other and each contains two 125-kw General Electric rotaries, a view of a pair of these machines being shown in Fig. 9, from which it will be seen that they are of the type with overhanging collector rings. They were set up with their shafts in line in order that they might be coupled together to allow for the turning of the commutators and to prevent pumping. Although the sub-stations are fitted with storage batteries, this available source of current for starting the rotaries as direct-current motors is not used, the machines being started from the alternating-current end. No reactive coils or compensators are provided, the alternating-current leads of the machines being simply closed, with the fields of the rotaries unexcited, the machines coming up to speed by an internal induction-motor action, this method requiring less skill on the part of the operators than starting from the direct current end. It would be preferable, in a plant of this kind, provided the operatives were sufficiently skilled, to start from the direct-current end, either by means of power transmitted from the generator at 600 volts, the 600-volt wires being normally connected together, or better by means of current from the storage batteries, and it was the intention of the designer of the system to operate them so by batteries ultimately, the only objection being the increased complication.

The rotaries are compound-wound and provided with

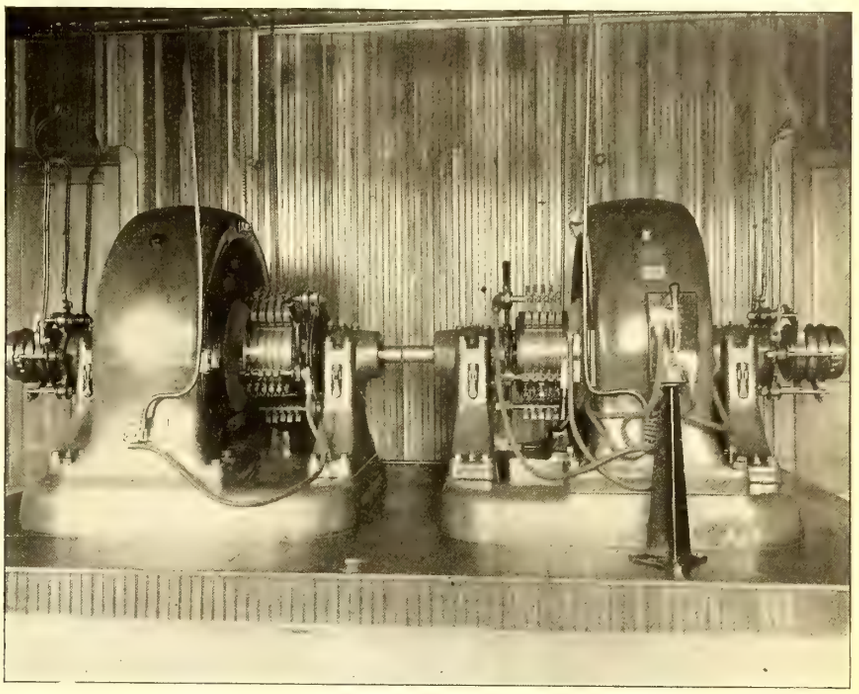


FIG. 9.—ROTARIES AT SUB-STATION

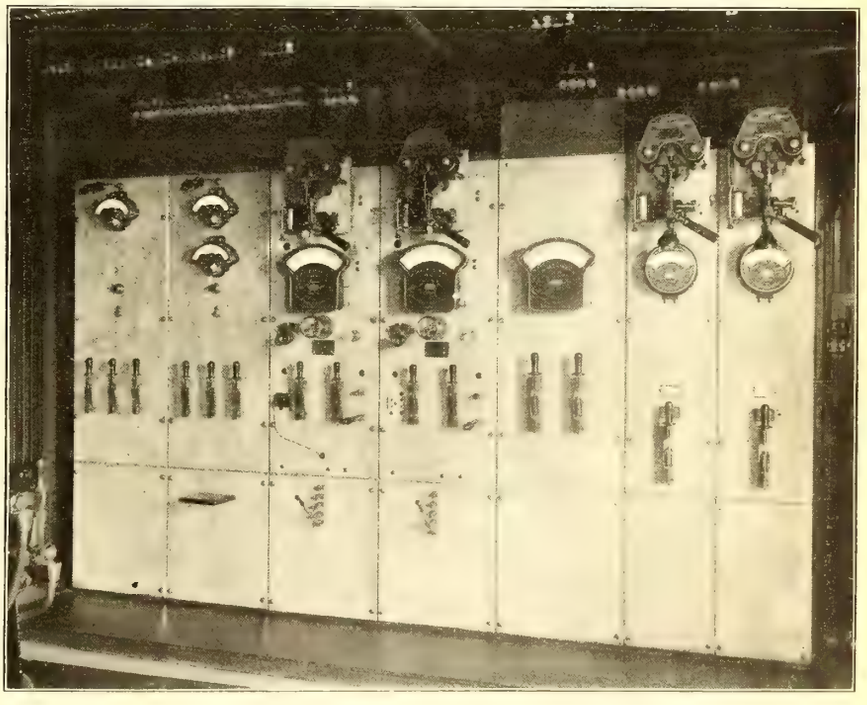


FIG. 10.—SWITCHBOARD AT SUB-STATION

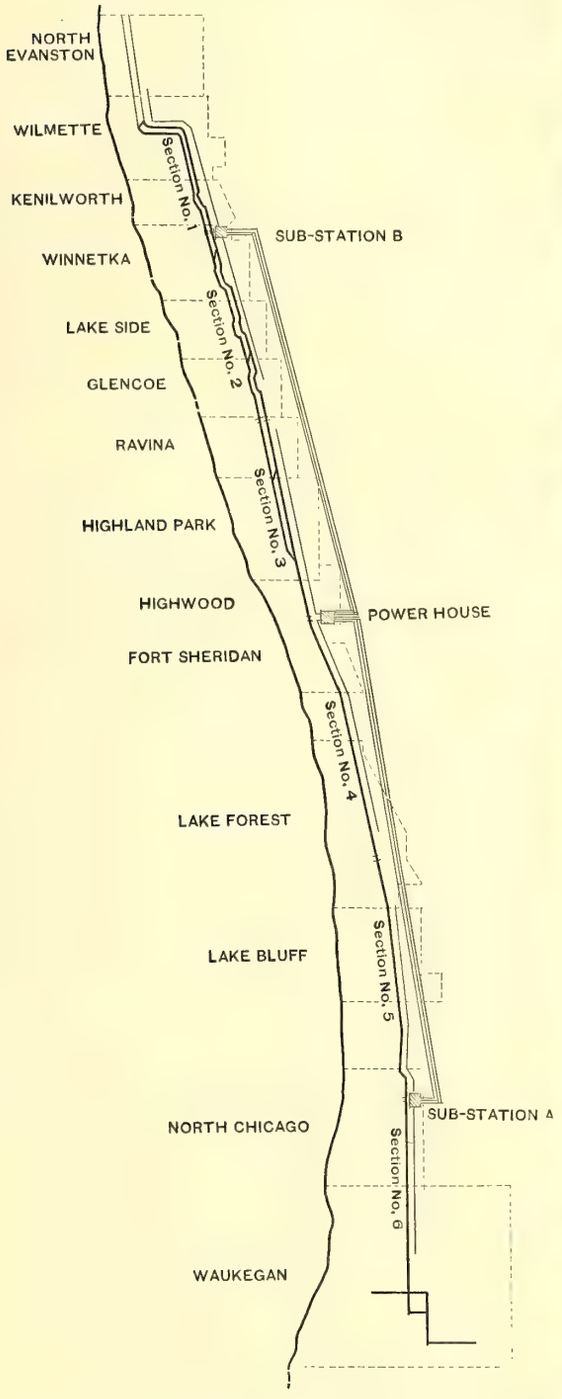


FIG. 11.—MAP SHOWING LOCATION OF FEEDERS

the usual equalizer, the series coils tending to keep up the voltage even without the use of special reactances in the alternating circuits, the reaction of the machine windings of the transformers and of the line being sufficient to give practically constant potential under load variations. There

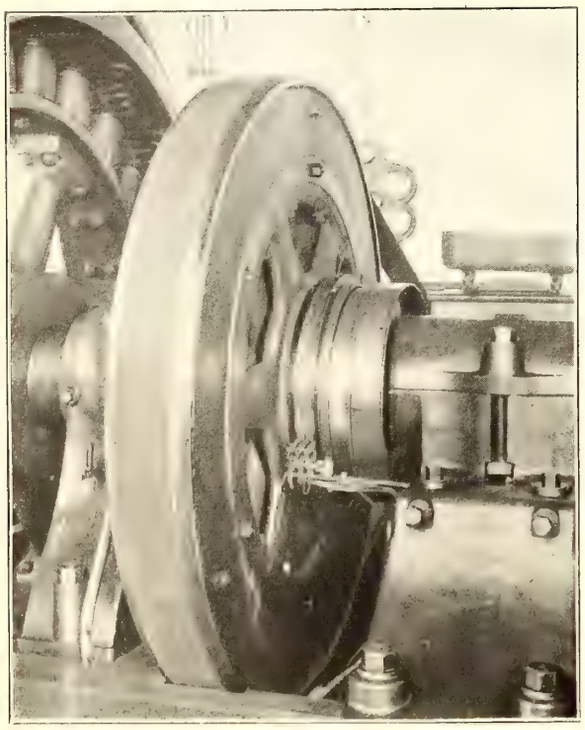


FIG. 12.—ONE OF THE MAGNETIC CLUTCHES, SHOWING COLLECTOR RINGS AND BRUSHES

are no circuit breakers in series with the batteries. No serious trouble is experienced with hunting of the rotary converters, even though the generators are driven by single-crank engines.

As noted above, the road, which runs on private rights of way for about three-fourths of its 27 miles, through many suburban towns scattered along the shore of Lake Michigan from Evanston to Waukegan, is equipped with some twenty motor cars and eighteen open trailers. The large double-truck through cars are equipped with G. E. 57 motors, geared up for a speed of about 30 miles per hour, which can readily be made on the long stretches of well ballasted private rights of way which exist between some of the towns passed through. The fares charged run about 1 cent per mile, varying from 5 to 35 cents, and the traffic developed during the short season the road has been in operation amounts to 7000 or 8000 passengers per day in the winter, and 30,000 to 35,000 in the summer, with more on Sundays and holidays.

The successful operation of this road with its several deviations from standard practice reflects credit on the gen-

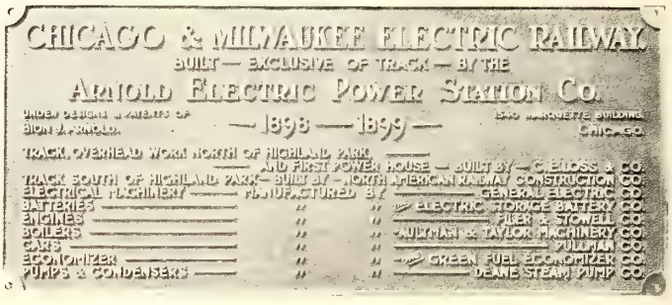

CHICAGO & MILWAUKEE ELECTRIC RAILWAY
BUILT — EXCLUSIVE OF TRACK — BY THE
ARNOLD ELECTRIC POWER STATION CO.
— 1898 — 1899 —
TRACK, OVERHEAD WORK NORTH OF HIGHLAND PARK
AND FIRST POWER HOUSE — BUILT BY — C. ELOSS & CO.
TRACK SOUTH OF HIGHLAND PARK — BUILT BY — NORTH AMERICAN RAILWAY CONSTRUCTION CO.
ELECTRICAL MACHINERY — MANUFACTURED BY — GENERAL ELECTRIC CO.
BATTERIES — " — ELECTRIC STORAGE BATTERY CO.
ENGINES — " — ALLIS-CHALMERS — STILWELL — ERIE CO.
BOILERS — " — HEINE — MUSTIN & TAYLOR MACHINERY CO.
CARS — " — PULLMAN CO.
ECONOMIZER — " — GREEN FUEL ECONOMIZER CO.
PUMPS & CONDENSERS — " — DEANE STEAM PUMP CO.

FIG. 13.—NAME PLATE ON SWITCHBOARD

eral superintendent, R. S. Ives, as well as on the various builders of the system and the apparatus used therein, whose names may be noted on the above reproduction of a name plate mounted on the switchboard of the power and sub-stations.

Polyphase Apparatus for Long-Distance Roads in Providence

The Providence & Suburban Railway Company, of Providence, R. I., operates several long-distance extensions in close connection with the city lines of the Union Railroad Company, of Providence. These companies are about to install an extensive three-phase system for supplying power from the Providence station to sub-stations on the extensions. Two 1500-kw three-phase 25-cycle General Electric machines will be erected as generators for this purpose. George B. Francis, formerly in charge of the engineering work on the Southern Terminal Railroad station in Boston, has charge of this work in Providence.

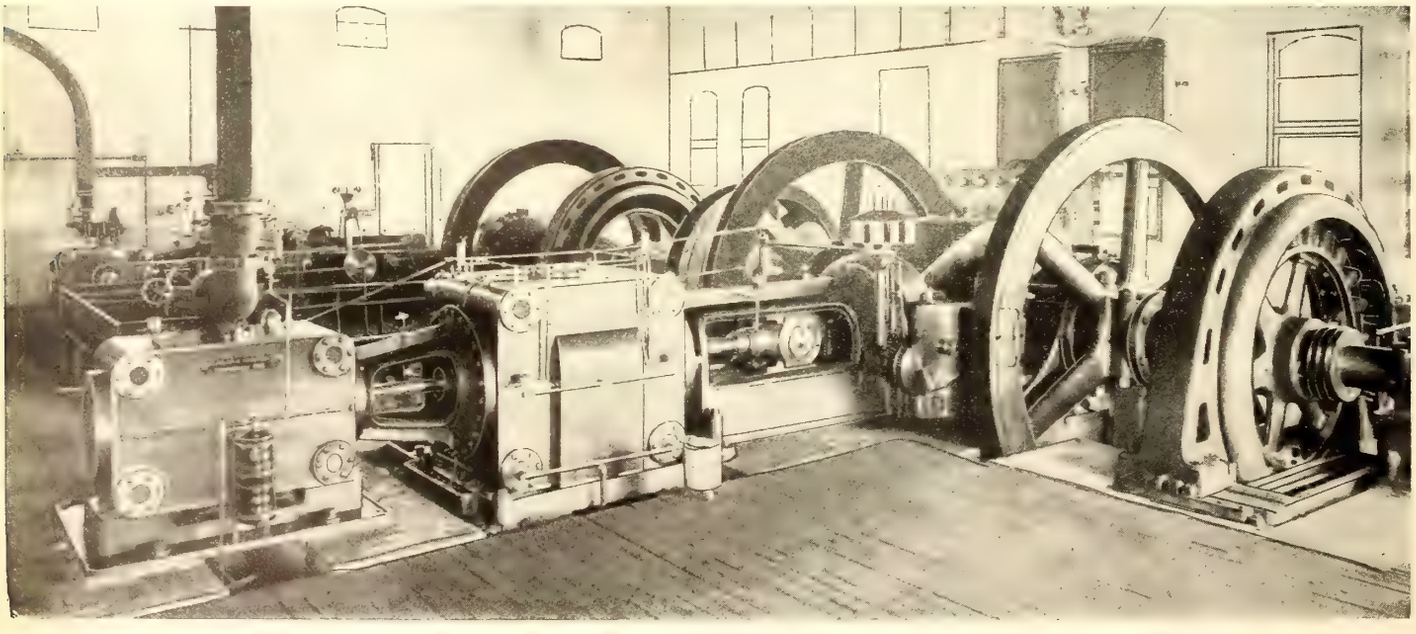
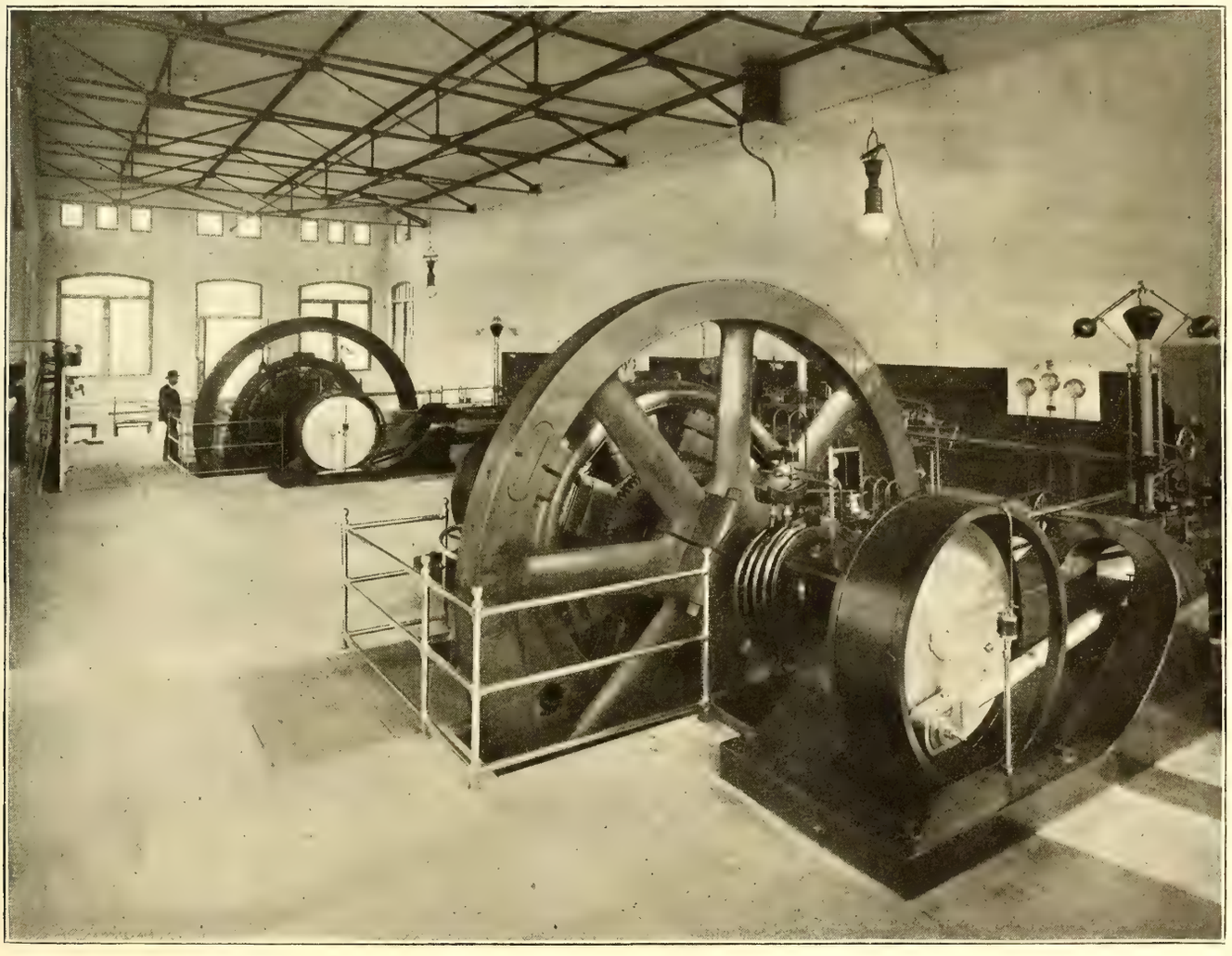


FIG. 14.—VIEW OF ENGINES IN POWER STATION

The Worcester & Webster Electric Railway

The City of Worcester, Mass., the second city in the State in wealth and population, compares very favorably with, if it does not exceed, Boston in the variety and extent of its industrial enterprises and is growing rapidly. For a long time the city displayed unusual conservatism in the introduction of suburban electric railway lines. But being the center of a highly industrial region, this condition could not long remain, and to-day Worcester is abreast of all rivals in local and suburban facilities for rapid transit.

Of the six distinct suburban lines now in operation, which practically annex to Worcester the principal towns and villages within a radius of 20 miles, and with various terminal connections beyond, the Worcester & Suburban Railway Company's lines to Spencer and Millbury were the first to be completed, and the Worcester & Webster Street Railway is the latest. This latter line, which has received much favorable comment for all that relates to thoroughness in construction, high speed and convenience, not to say luxury, of the traveling public, is the subject of this article.



INTERIOR OF ENGINE ROOM, WORCESTER & WEBSTER ELECTRIC RAILWAY

The route runs through one of the most beautiful and picturesque sections of Central Massachusetts, passing southward through the old time settlements of Auburn, North Oxford and Oxford, the latter a typical New England town of homes and churches, with many historical associations, including the remains of the old fort of early Colonial days on Huguenot Hill. Continuing through East Webster, a delightfully rural region, to the busy town of Webster with its population of 12,000, the pleasure seeker by this route arrives within a short distance of one of the largest fresh water lakes in the State, enjoying the euphonious Indian name of "Chaubunagungamaug."

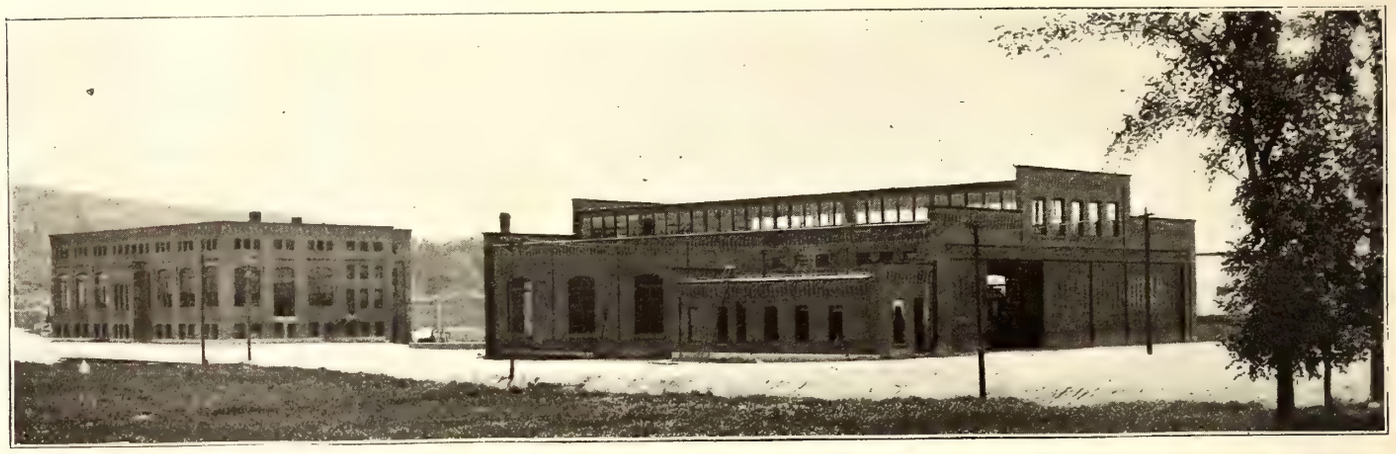
The company was organized with a capital stock of $150,000, rights of the various towns obtained, and $150,000 worth of bonds have been issued. The engineering of the whole enterprise was conducted by E. E. Carpenter, president and manager of the New England Electric Railway Construction Company, of Worcester, Mass. The work of construction was begun in the spring of 1899 and the cars were in operation in the following September, in spite of many obstacles of grade and alignment.

This task included the building of $3\frac{1}{2}$ miles of new streets in the towns of Auburn and Oxford, with roadbed of gravel, bridges of steel I-beams, with 60-lb. steel rails, 60 ft. long, on 7-ft. chestnut ties, and equipped with 00 copper trolley wire, 500,000 circ. mil, rubber covered and 0000 copper feed wire, with turnouts about 350 ft. long and automatic switches. The ties are chestnut, 5 ins. thick x6ins.face, and are spaced 2 ft. centers. The joint plates are the standard four-bolt, 24-in. angle bar. The bonds are all No. 0000, about one-half being of the Protected type, the others being Crown bonds. The poles throughout are of chestnut, 30 ft. long and 10 ins. in diameter, 5 ft. from the butt, except in the village of Oxford, where octagonal hard pine poles 30 ft. long are used. The overhead material is of the West End type, with General Electric switches and flexible brackets.

The company has a fine location in the town of Oxford

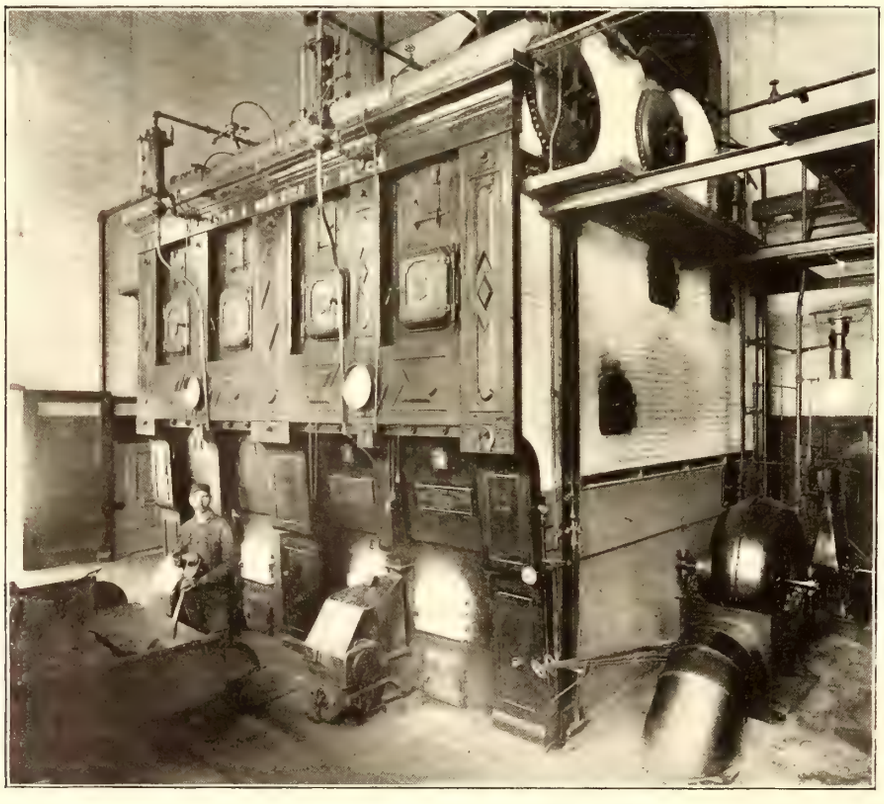
for the power station and car house, on a lot of land situated between the main street and the N. Y., N. H. & H. R. R., consisting of about 3 acres, with a frontage of railroad of about 100 ft.

The power station is of brick with granite and brownstone trimmings, as shown in the engraving. The engine room floor is of steel with brick arches and granolithic top.



POWER STATION AND CAR HOUSE

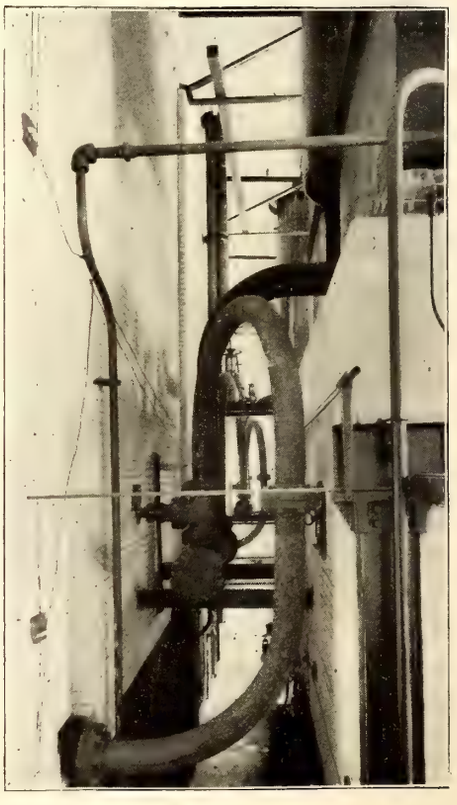
The boiler room floor and the floor under the engine room is of 4-in. Portland cement concrete, and is absolutely fireproof. Owing to this construction it will not be necessary to carry any fire insurance on buildings or equipment. The power equipment is about 1000 hp, with buildings large enough to double the capacity when needed in the future.



BOILERS AND UNDERFEED STOKER

The boilers are of the Stirling water-tube pattern, fitted with the American under-feed stoker, which has proved very satisfactory on other New England roads. The company also uses mechanical draft, having installed a No. 9 Sturtevant blower directly connected to a small steam engine. By this means no large stack is needed and the draft is automatically regulated by a very unique arrangement, consisting of a Spencer damper regulator attached to the blower engine steam valve.

The pump room is a separate compartment 12 ft. 6 ins. x 18 ft., equipped with one large duplex Blake pump for use in filling the feed-water heater, and the entire water system for both the power station and car house is arranged to work automatically and to maintain a pressure of from 100 to 150 lbs. For emergency use, one smaller and two larger pumps are used, each of the latter being capable of feeding the large boilers from the Cochran heater, which heats the water from 210 to 212 degs., by economizing the exhaust steam from the pumps and condensers.



HEADERS AND MAIN

The steam piping is of bent pipe, all put in by the Carman, Thompson Company, of Portland, Maine, and there are three distinct ways of feeding the water to the boilers, so in case one should become defective there are two other ways of supplying water.

The engine room is complete in every particular, fur-

nished with two direct-connected, cross-compound Hamilton-Corliss engines of 600 hp each, of 120 r. p. m., and two 275 kw direct-connected Westinghouse generators on foundations 12 ft. high, built of brick all laid and puddled with Portland cement on 18 ins. of crushed stone and Portland cement concrete. The entire building is fitted with hot and cold water and open plumbing. The gravity oiling system is used, the oil running on the bearings all the time and then passing through a pipe to the filter, where it is filtered, pumped to tank and used over again.

The coal pocket, of the steam railroad trestle pattern, is large enough to hold 25,000 tons of coal. The coal descends through chutes to hand cars which run on a track passing through the boiler room in front of the boilers. The boiler room is also connected with the main line of track for the removal of cinders and ashes to the roadbed by the construction car at one operation.

The car house, which adjoins the power station, is of brick with brownstone trimmings well arranged and ample

INTERIOR OF CLOSED CAR

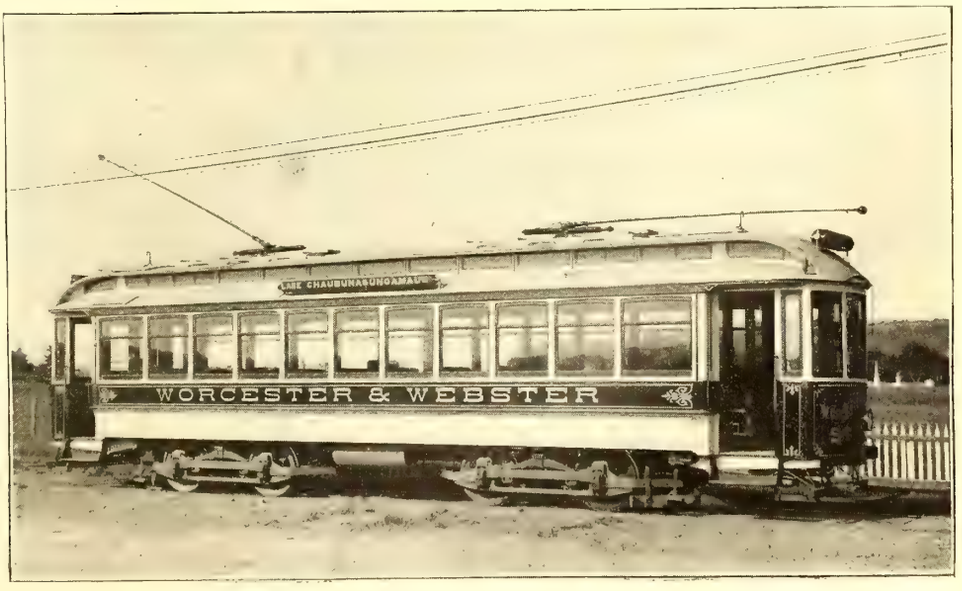
INTERIOR OF CAR HOUSE

for the purpose, having seven tracks and a "Y," including front sliding doors hung at the top, and the trolley wire is arranged to extend whole into the house without cutting. The office, conductors' and motormens' headquarters are furnished with all necessary appointments. The plans for the station and car house were drawn by J. William Patston, architect, of Worcester, Mass.

The company has reason for great pride in its rolling stock, which consists of seven handsome box or closed cars, about 43 ft. long. They are finished in quartered oak inside, with plush cross seats, and each has a capacity of from forty to forty-four people. There are eight fifteen-bench and two twelve-bench open cars. The cars, which are illustrated herewith, were built by the Laconia Car Company Works, of Laconia, N. H. All the cars are mounted on Laconia double trucks, with the motors suspended outside the axles. International registers are used.

Each car is equipped with two 50-hp Westinghouse high-speed motors and Standard Air Brake Company's axle-driven air compressor brakes and chime whistles, and the new Carpenter sand box, the invention of E. E. Carpenter, of the New England Electric Railroad Construction Company.

In addition to the electric push-button signal for stopping, each car carries a telephone, which allows the making of connections to the car house from any point on the line. This is accomplished by using a telephone wire running the entire length of the line, and di-



STANDARD CLOSED CAR

rectly connected with the car by a bamboo pole properly wired. The cars are not dispatched by telephone, but in case a car is delayed and obliged to wait at a turnout, the conductor can call up the main office and receive orders as to whether to wait or go ahead, thereby avoiding any liability of accident by trying to steal switches.

The road is also furnished with a large construction car equipped with motors and all electrical appliances for repair work or in case of accident; also two Taunton snow plows.

A parlor car is now building from special designs which is to be one of the finest of its kind ever built. It is 45 ft. long, with parlor, smoking room and toilet compartments with buffet and refrigerator appointments. The finish is mahogany with artistic carvings, bevel plate glass and art glass, mirrors and windows, and has a seating capacity of twenty-four luxurious parlor chairs, both cane and upholstery. These, with electric push-buttons, call bells and telephone system, make this palatial car one of the finest of its kind in the country.

Although the line has been in operation but a few months, it already has a large through and local patronage and is destined to be the popular route for quiet pleasure seekers as the season advances. As stated, the total cost of construction and equipment of this line, which is about 17 miles long with turnouts, was about $400,000. Of this amount the roadbed and track cost about $110,000; the special work, grading, switches, frogs, new streets, fenc-

VIEWS ON LAKE CHAUBUNAGUNGAMAUG

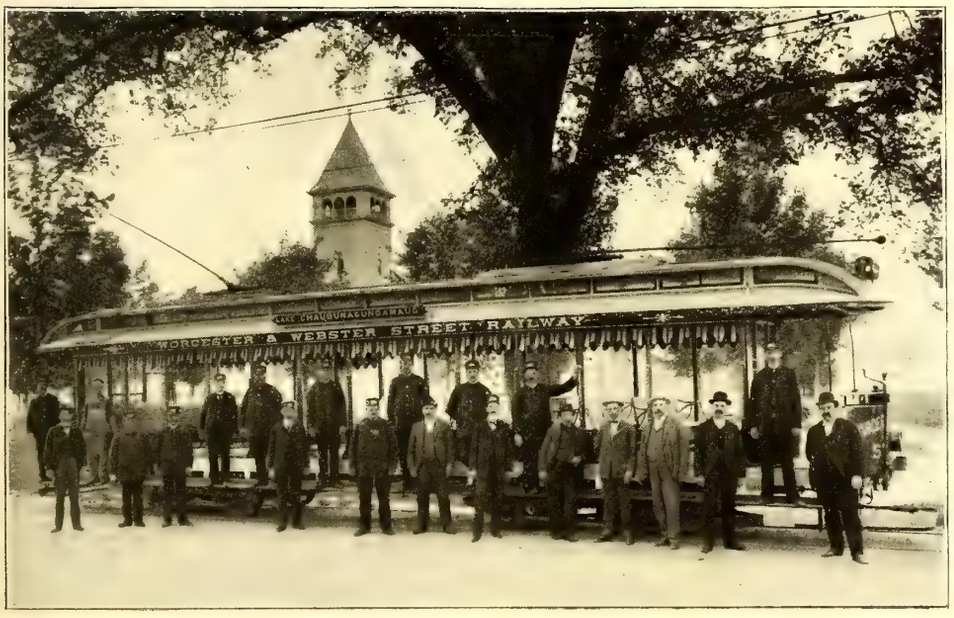
ing, etc., about $60,000; the overhead materials, including poles, brackets, feed-wire, trolley wire, etc., about $48,000; the rolling stock, about $47,000; the car house, complete, about $22,000; the power station, about $30,000; the land, well, grading, etc., about $8,000; the power station equipment, about $70,000; the miscellaneous items, such as office furniture, telephone system, tower wagon, etc., amounted to about $5,000.

The officers of the company are Julius Garst, president; Fred Thayer, vice-president; W. A. Bailey, treasurer; E. L. Parker, auditor. The construction, as stated, was performed in its entirety by the New England Electric Railroad Construction Company, of Worcester, Mass., of which Mr. Carpenter is head, and H. F. Leland the clerk and treasurer. With Mr. Carpenter were associated Charles A. Midddlemas and H. F. Lincoln, the constructing engineer of the New England Electric Railroad Construction Company. These gentlemen have received many compliments upon the very successful manner in which this road has been equipped.

CAR HOUSE

Testing Public Opinion in Chicago.

The agitation over changing the motive power on the lines of the Union Traction Company, of Chicago, led to a novel test of public sentiment June 19. Baskets were put on the cars and each basket had beside it an invitation for each passenger to place in it a ballot expressing his opinion upon the present system of transit. The inquiry was made by the North Side Business Men's Association. The result was that 3802 voted in favor of the overhead trolley, and only a few cast ballots for other methods of transportation. This is a pretty good indication of the satisfaction given by the trolley system, as compared with the other methods employed in that city



VIEW OF CAR AND OPERATING FORCE

German Managers to Make a Trip of Inspection to America

Under the auspices of the Verein Deutscher Strassenbahn und Kleinbahn Verwaltungen, which is an association comprising the principal street railway companies of Germany, an extensive trip of inspection will be made by a number of members of that association to the United States next year. The object of the trip is to study the latest developments of electric traction, both surface and elevated, in the different cities. From twenty to twenty-five gentlemen have already signified their intention of joining the party, and it is thought that the advantages of the trip, as showing the latest developments of American practice in electric railroading, will appeal so strongly to other members of the association that before the date of starting the party will comprise representatives from practically all of the larger cities of Germany, as well as of some of the larger manufacturing companies. The party will leave Germany during the early part of May, 1901, by either the Hamburg-American or North German Lloyd line, and New York will be the first city visited. Other cities which the party is planning to visit are Boston, Cleveland, Chicago, St. Louis, Cincinnati, Washington and Philadelphia. The entire trip will occupy from six to seven weeks, of which from fifteen to seventeen days will be occupied by the ocean voyage. The party will spend one day at Niagara Falls on the trip between Boston anod Chicago. The cost of the trip, including the steamship travel, railroad fares, etc., is estimated at about M3,000 per person. This is considered an outside figure, and should include all expenses. Heinrich Vellguth, secretary of the association, has the details of the trip in charge.

Form of Train for Reducing Air Resistance

Although somewhat outside of electric railroading the experiments now being carried on by Frederic U. Adams on the Baltimore & Ohio Railroad, in an effort to reduce air resistance, will be of some interest to workers in high speed electric railroading, whether the results prove successful or not. A great many attempts have been made to reduce this part of a train's resistance, a factor which, at high speeds, is undoubtedly a very important one. The subject was quite thoroughly discussed in a series of articles in the STREET RAILWAY JOURNAL about a year ago, in which one writer, Henry Graftio, formerly chief engineer of the Heilmann Company, of France, stated that he believed that a form of train in which the spaces between the cars were closed, and the front and rear of the train were provided with shields, shaped somewhat like the bow and stern of a boat, would appreciably reduce the air resistance of the train. The closing of the spaces and the shape of the rear car were considered more important than the pointed shape of the front end of the train. This opinion coincides with the views held by Mr. Adams, who has been working on the subject for the last ten years.

FRONT END OF TRAIN

REAR END OF TRAIN

In the tests made with the train shown it is claimed that a considerable reduction in train resistance has been secured, and a gain of from 7 to 10 miles an hour was made with the same engine over the same tracks, drawing the test train, and also a standard train with the same number of coaches. No very accurate measurements of power, however, have as yet been obtained, so that it is impossible at the present time to predict what the saving will be, if it is practically anything. It is understood that a special dynamometer car and tender are in process of construction, and when experiments are made with this apparatus greater knowledge can be had as to the practical value of the device. It seems to be generally admitted that the pulling back action of the last car is one of the principal factors in train resistance. It would be interesting to place the dynamometer car both ahead of the cars and in another test just ahead of the rear car, and thus determine whether the shape of the rear car on Mr. Adams' train actually lessens the train resistance. It is needless to say that the reduction effected is only that produced by the air resistance ahead, and that the train resistance caused by flange friction produced by a side or quarterly wind is not reduced by the form of the train.

In the train, as now constructed, the tender is built up to the height of the car so that there is no break between the engine cab and the baggage car. The windows are set flush with the sides of the car. The sides of the cars extend down so as to nearly enclose the trucks and to prevent the air from impinging against them. The platform doors extend to the bottom of the steps, and are flush with the sides. The spaces between the cars are closed with flexible connections which accommodate themselves to all curves and the various complex motions of a train at high speed. The roof is arched and is perfectly smooth. The rear car tapers to a point. In the train now being tested nothing has been done to the engine, as Mr. Adams decides to show that the cars are the greatest violators of the laws of speed.

The second novel feature is the ventilating system. All the air for ventilation is admitted from the front end of the tender, where there is an absence of smoke or dust. It is carried along passages in the roof, which connect when the cars are coupled. From these ducts the fresh air is distributed through the train.

United States Consul McGinley at Athens writes, under date of May 14, 1900: "From reliable sources, I have learned that the Athens and Piræus Railway Company must, according to conditions in its franchise, adopt electricity as the motive power for its trains within the next three years. This road extends from the quay in Piræus to the business center of Athens, some 5 miles, three-fourths of a mile of the distance being through a tunnel under a portion of the city. A Belgian company which owns and operates a steam tramway between Athens and Piræus, via Phaleron, also wishes to adopt electric power for its trains; but how soon it desires to make the change has not been learned. Each road has a very large passenger traffic, especially in the summer season.

The Largest Electric Railway Company in Germany

Berlin, which, with its suburbs, has a population of 2,400,000 inhabitants, has a system of transportation which is the most complete in Germany, and ranks high compared with that in any other metropolis. The long distance traffic and that between the various steam railroad stations is cared for by the Stadt- und Ringbahn. This line has thirty-five stations. Its total length (measured as single track), is 65.17 km. (40.4 miles), of which 13.58 km. (8.4 miles) and fourteen stations, belong to the Stadtbahn. As the road is to a large extent elevated on stone arches through thickly populated city districts, great difficulties were encountered during construction, which easily explains the enormous capital investment of M.110,000,000 ($27,500,000) for its construction.

The most important institution for the local traffic of Berlin, and at the same time the largest undertaking of its kind in Europe, is the Grosse Berliner Strassenbahn, which has a stock capital of over M.67,000,000 ($16,750,000). On this road, including the Westliche und Sudliche Berliner Vorortbahn, 223,700,000 people were transported last year, and its cars, exclusive of trailers, traveled 22,300,000 km. (13,726,000 miles). About one-half of this road is operated by electricity, and probably not later than two years from now this will be the only motive power.

Besides the above there are other electric roads operating in Berlin, notably the Berlin-Charlottenburger Strassenbahn, the most important section of which was at first operated by accumulators only, but on part of which the overhead trolley has been installed. This company has also decided to supplant the horse on all its lines by electric power, and the order to do this has already been placed with Siemens & Halske. The same firm also constructed the Berlin Elektrischen Strassenbahnen, a portion of which (2.1 km) is operated by underground trolley, and another portion (16.3 km) by the overhead trolley.

On Oct. 21, 1899, another road, built by Schuckert & Company, was opened to the public. This road, which is 6.6 km. (4.1 miles) in length, carries freight as well as passengers, and is equipped entirely with the overhead trolley. The Stadt- und Ringbahn, already referred to, is the only existing elevated road in Berlin, but as early as 1891, Siemens & Halske submitted a design for an electric elevated road, and at the same time the Allgemeine Elektricitäts Gesellschaft formulated a plan for a connecting system of underground railways. The first proposition received Imperial sanction on May 3, 1893, for the section Warschauer Strasse-Nollendorf Platz, and work was begun in 1895 after much wrangling with the city in regard to the charter. The greater part of the road has already been completed, and the company formed for the construction of the road believes that the entire line from Warschauer Strasse to the Zoological Garden will be completed in 1901. Part of this line will be built underground, the other part elevated.

The permission to build a deep underground road has not been granted up to date, but the Company for the Construction of Underground Roads was able to celebrate on Sept. 1, 1899, the successful completion of the Spree Tunnel. This tunnel, which leads from Stralau to Treptow, is remarkable in many respects. It is the first underground passage which in its entirety is built in quicksand, and the first in Germany to be excavated exclusively by means of the breast shield. The electric road, which utilizes this tunnel, starts from the Schlesische depot, passes through Stralau, and ends at Treptow, and in the tunnel a speed of 13.5 km. per hour is attained.

Besides the surface cars several omnibus companies take care of the traffic of Berlin, and there is also a well organized cab system. At the beginning of 1899 there were in service 231 omnibuses and 8096 cabs. Omnibus and cab owners are at present experimenting with automobiles. Whether it will be possible to train a set of men so that they can operate these vehicles, especially heavy busses, without danger to the pedestrians, through the crowded streets of the Metropolis is a question which the future alone will answer.

To describe all these various means of transportation in vogue in Berlin, however, is not the intent of this article, but to consider only the most important road, namely the Grosse Berliner Strassenbahn. Nor will the history of this road, which was founded in 1871, be considered. Those who are interested in this aspect of the question are referred to a very excellent pamphlet on this subject, entitled "Twenty-Five Years of the Grosse Berliner Strassen-

FIG. 1.—MAP OF BERLIN, SHOWING THE LINES OF THE GROSSE BERLINER STRASSENBAHN

bahn," published by Bergmann, Wiesbaden, in 1898. The present article will be limited, therefore, to the introduction of electricity on the road, and to its status at the close of the past year.

The Grosse Berliner Pferdeeisenbahn A. G., as the present Grosse Berliner Strassenbahn was called until the beginning of 1898, made experiments with accumulator cars, the so-called Reckenzaun system, as early as in 1884 and 1885. The batteries, however, were not commercially reliable, so that after a short time the cars were dismantled and horses were again employed. Electrical experiments were then discontinued until soon after the opening of the Berlin Industrial Exhibition in 1896, when the managers of the road succeeded in obtaining permission from the city to introduce electricity, using the overhead trolley on several of its lines, which were being greatly crowded, due to the Exposition. The Union Elektricitäts Gesellschaft was asked to furnish fifty motor cars, and to equip several lines. The work was pushed vigorously, and when the Exposition was opened on May 1, 1896, a part of the system was in operation, the remainder being ready by June 29 of the same year.

The year 1896 might be called the experimental year for the introduction of electricity as a motive power on the Berlin street railways. The overhead system amply met the extraordinary demands made upon the road by the Exposition crowds, and was shown to be far superior to horse power for the transportation of large masses of people.

In December, 1897, negotiations leading to a definite introduction of electricity on the entire system of the Grosse Berliner Strassenbahn were finally brought to a close, due to the granting of the Emperor's consent, and motor cars were ordered at once, and the equipment of the line was begun. The execution of the work was intrusted to the Union Elektricitäts Gesellschaft, and was superintended by its engineer, Mr. Bjorkegren, who also supervised the construction of the Bremen and Hamburg roads, the latter ranking in size after that in Berlin, and well-known on account of its superior equipment and operation.

FIG. 2.—VIEW AT ALEXANDER PLATZ, SHOWING SPAN WIRE CONSTRUCTION

As the use of the overhead trolley was not permitted in the central and western portion of Berlin, it was decided to introduce the so-called mixed system on these lines, in which the battery is charged while the car is on the portion of the road equipped with trolley, and furnishes currrent for the motors on those portions where the trolley is forbidden. It should be added, however, that recently several of these branches originally equipped with the mixed system are now operated entirely by trolley.

On March 1, 1898, the Schöneberg-Alexander-Platz line was opened. It is 7.1 km. (4.3 miles) in length, 3.4 km. (2.1

miles) of which is operated by means of accumulators. On this line the double truck cars were first used. On May 11 followed the opening of two other lines, and in the following summer and fall four more lines, among which was the 14 km. (10.5 miles) belt line. As a result, the car mileage just about doubled.

In 1899 the electrification of the road was contiued with even more energy, so that at the close of 1899, nearly one-half of the city, and over one-half of the suburban lines, are electrically operated. The equipment is divided as follows: Overhead trolley, 105 km. (65 miles); accumulators, 16.5 km. (10.2 miles). Measured as single track the entire system now operated by electricity consists of 244 km. (151.3 miles), on 34 km. (21 miles) of which accumulators are the road. The Electric Works in each case supply the feeders, and the current is measured at the point of feeding to the trolley wire. There are a total of seventy-seven feeding points at present. At each two wattmeters are located, from which the current consumption is computed, one meter being placed there by the works furnishing the current, and the other by the management of the road. Fig. 12 shows a section box, in which two such meters of different types have been placed.

The several sections supplied with current are separated from each other during normal operation by section insulators, but they can be connected together by means of switches. The trolley wire is also separated into sections every 500 meters, these sections are ordinarily bridged by

FIG. 3.—TYPICAL STATION, BERLIN ELEVATED RAILWAY

used. When completed the system will comprise about 475 km. (294.5 miles) of track. In 1899, 13,910,000 kw-hours were consumed, and 22,278,835 motor car and trailer km. (13,812,678 car miles) were traveled. In these figures the results of operation of the Neue Berliner Pferdebahn-Gesellschaft, as well as the Westlicher und Sudlicher Berlinen Vorortbahnen have been included. The first named company was amalgamated with the Grosse Berliner Company early in 1900, and the same management operates all three roads.

By far the greatest portion of current used by the road is purchased from the Berlin Electric Works, the rest being purchased from Schöneberg Electric Works and the Charlottenburg Electric Works. From July, 1898, to July, 1899, Berlin Electric Works furnished 28,893,947 kw-hours, of which 35 per cent were used for the operation of a section cut-out. At crossings the section cut-outs are close together, and are never more than 100 meters from the crossing.

The trolley wire is of hard drawn copper, is 8 mm in diameter (No. 0 B. & S.) and is supported every 35 m to 40 m. The insulator is of the "West End" pattern, which was used here in Europe for the first time. Up to date, about 4700 tubular poles and 200 built-up poles have been placed in position, as well as 4000 rosettes with noise dampeners. As in most German installations, special care was taken to design and use poles which would thoroughly harmonize with their surroundings, and in Fig. 6 is shown the type of pole and arm most commonly seen in Berlin. The built-up type, also shown, is employed only in suburban districts and along sparsely populated streets. At certain points, special poles, with double candelabra, designed by

the royal architect, Schwechten, have been placed, as in front of the Emperor William Memorial Church. The designs of rosettes also correspond to the architecture of the buildings to which they are attached. That the noise dampeners which are used in connection with the rosettes work effectively, by the use of gutta percha insulation, is shown by the fact that of the 4000 rosettes installed, not more than thirty had to be removed, and this on account of a change about to be made on the building or because the building itself passed into the hands of owners who wished them removed.

The trolley wire is suspended 6 m (19 ft. 6 ins.) above the heads of the rails, but this distance is decreased to 4.5 m (14 ft. 10 ins.), the smallest permissible height under bridges and railroad spans, as shown in Fig. 11. The greatest span within city limits was necessitated at the Jannowitz bridge, where the distance from pole to pole is 80 m (262 ft.). In Fig. 5 is shown the method of suspension adopted in crossing the Colonnen bridge, the span being 100 m (328 ft.) in length.

The current is returned through the rails, which are bonded by means of copper in the usual manner adopted by the Union Company, and specially laid cables. The change to electric traction necessitated the replacing of a large number of rails, such as the Larson, Fischerdick, Haarman and 13-cm (5-in.) Phœnix by rails of more modern design. The standard rail used is of the Phœnix girder type 160 mm (6¼ ins.) high, with central web 11 mm (0.43 in.) thick. The lip is only 15 mm (0.6 in.) in width, and on new rails lies 3 mm (0.12 in.) below the running face. The lip was designed narrow, so that wagons passing over the rail would wear all parts of it equally, and thus a step formation would be prevented. The section finally adopted was the result of this company's long experience, and was rolled after the design of the royal engineer, Mr. Fischer-Dick. Most of the track is laid in concrete, and where this was impossible, on a bed of gravel, as shown in Figs. 56 and 7. The rails are nearly all joined by means of the Schmidt half-lap fish-plate, in which 50 cm (20 ins.) of the angle-plate is countersunk into one-half the rail-head at the joint. Since the beginning of 1898 the Falk cast rail-joint has been used on several portions of the road to a considerable extent, as has been described in these columns.

Besides the rails, nearly all the special work had to be replaced. That at present is mostly of the made-up type. The shortest radius of curvature is 16 m (53 ft.), the steepest grade is 4 per cent.

The underground conduit electric system is not in use at present on the road, nor is there a single instance of a simple accumulator system; the lines have the overhead trolley either on part of or on their entire length, or else the mixed system, where the battery furnishes current only along those portions where there is no trolley wire.

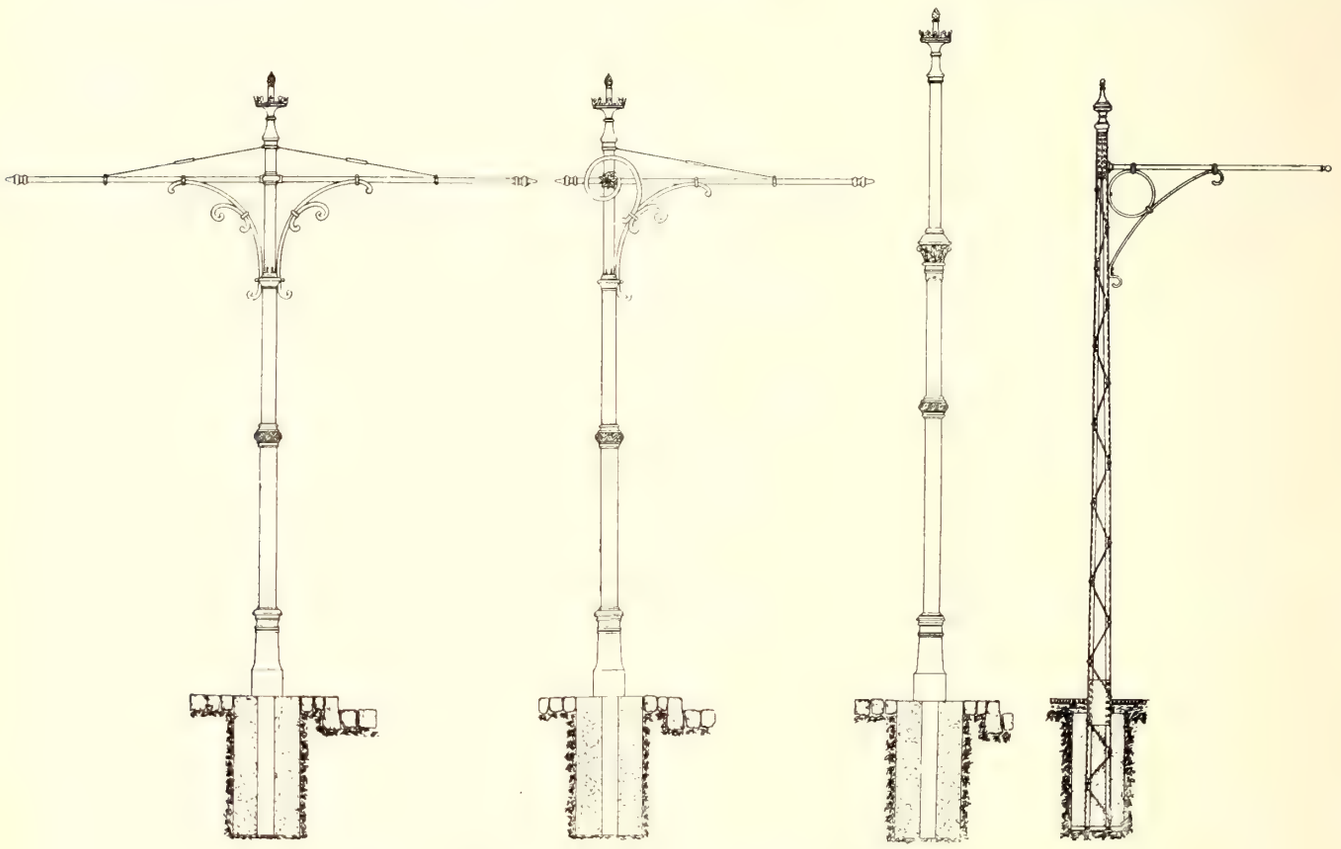


FIG. 4.—TYPES OF TUBULAR AND LATTICE POLES USED

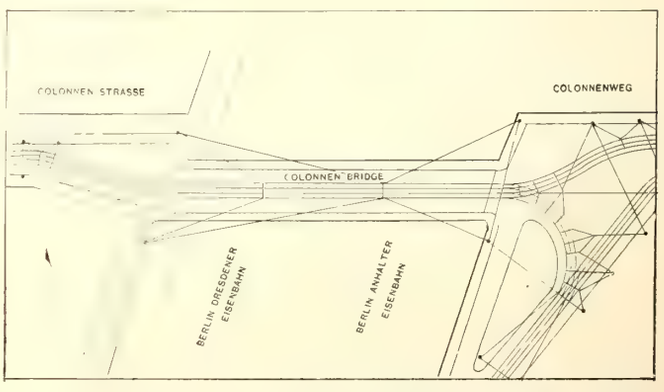


FIG. 5.—METHOD OF SUPPORTING TROLLEY WIRE WITHOUT POLES, ON COLONNEN BRIDGE (328 FT. LONG)

The accumulator system, which requires neither an expensive roadbed, like the conduit system, nor the overhead construction, is generally believed by the general public, to be the most perfect of all electrical systems, but, in addition to the weight, the acid fumes from the battery

have been found in Berlin to be offensive, in spite of the great care exercised in guarding against their escape. The separate cells must be completely cleaned out from time to time, and even then the experience in Berlin has been that the escape of gas cannot be avoided. Moreover, even in a comparatively new cell, the superoxide deposit which gathers on the plates causes a local discharge of the cell, thus greatly reducing its efficiency. Again, if the traffic is not quite normal, the time during which the cars are on the trolley sections is not sufficient to charge the cells so that they can carry the car over the sections where there is no trolley wire. It was also found on Dec. 11, 1899, in again using the accumulators for the first time after a heavy fall of snow, that they were far from satisfactory. All the stoppage and delays, the most serious which the road had encountered for ten years, were caused by the accumulators failing to meet the traffic demands. Besides, the expenses to maintain such a system are considerably increased. It was originally thought in Berlin that the accumulator (mixed) system would cost 6 pf. per km (2.4 cents per car mile) more than the overhead system, but it was found that this figure had to be increased 40 per cent. For an extensive overhead system the use of accumulators is rather a disadvantage, as the weight of the battery (2.8 tons on large cars) has to be transported along the entire distance as a dead load. On several lines where the traffic is densest and delays must be avoided at any cost, the city authorities have recently permitted the provisional installation of the overhead trolley, where formally its use was prohibited.

Another change necessitated by the adoption of elec-

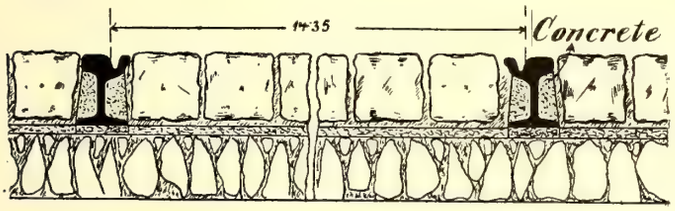


FIG. 6.—TRACK CONSTRUCTION IN BLOCK PAVING

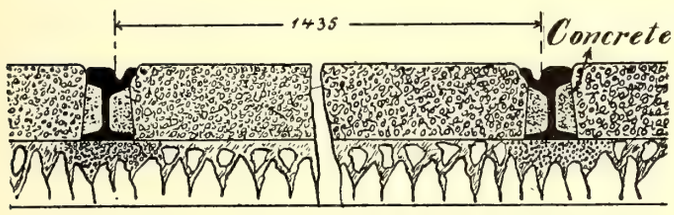


FIG. 7.—TRACK CONSTRUCTION IN MACADAM PAVING

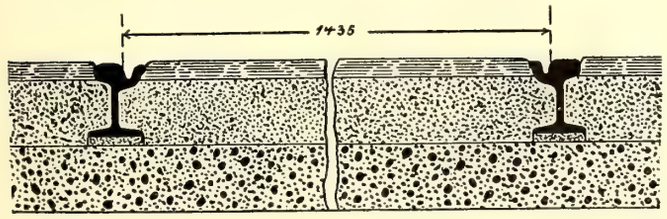


FIG. 8.—TRACK CONSTRUCTION IN ASPHALT

tricity as a motive power was the extension of the rolling stock. For the two lines opened in 1896 only fifty motor-cars were purchased, each being equipped with two motors of 13.5 hp, using 28 amps. At the close of 1897 the report of the company showed an ownership of only fifty-five motor-cars. One year later this figure rose to 375, 202 of which were designed for mixed service. At the close of 1899 the company owned 300 cars for mixed and 400 for the simple overhead system. For the complete road, as now planned, at least 1200 motor-cars will be required, 600 to 700 of which will probably be equipped with accumulators. Fifty cars were bought in America in order to obtain American designs; the remainder were of Ger-

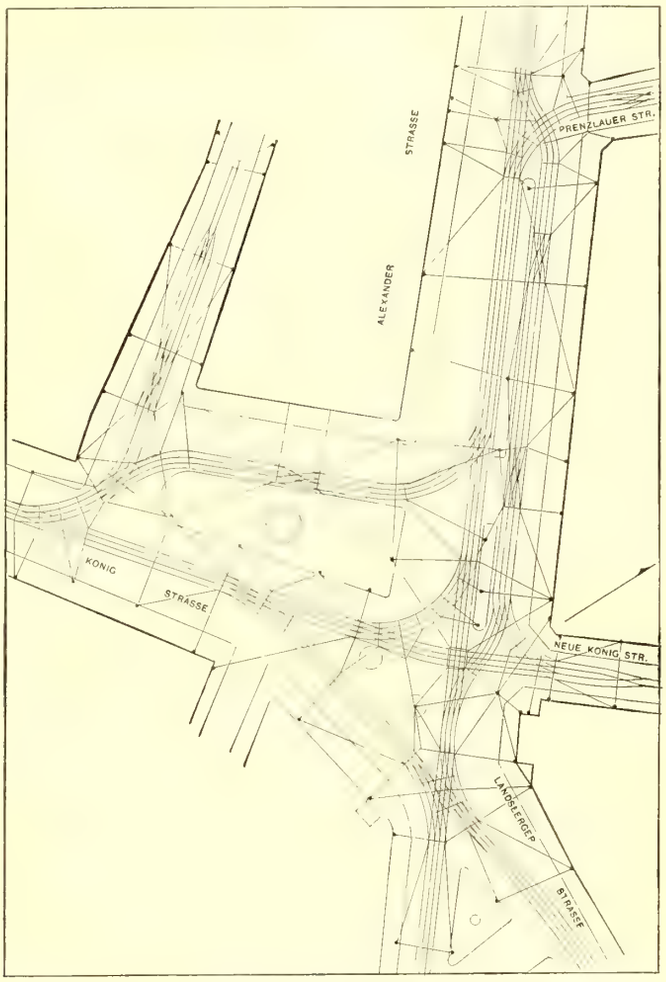


FIG. 9.—DIAGRAM OF OVERHEAD WIRING AT ALEXANDER PLATZ

man pattern and made in Germany. The two types differ mainly in the frame construction and the arrangement of the truck springs. The so-called St. Louis cars have cross seats, but these are not well adapted for Berlin street service, as the cars on several lines are only 2 m (6 ft. 6 ins.) in width, which is hardly sufficient for this type of car.

The trucks were furnished by the Bergische Stahl Industrie. The side frame for the single trucks, which are of the "model Berolina," are large steel castings united by flat iron cross-bars. The wheel-base on the single trucks is 1.750 m (5 ft. 9 ins.), and on the double trucks, 1.400 m (3 ft. 7 ins.) The double trucks were designed by Chief Engineer S. Peiser, of the road, who also drew up the plans for the car bodies and single trucks.

The new cars are equipped with two motors, which are protected, as are all the car-motors manufactured by the Union E. G., by a completely closed magnetic field. Each motor weighs 785 kg, has a capacity of 23 hp, and consumes 44 amps. The power is transmitted to the driving axle and cast steel wheels by means of gearing, at a ratio of 1:4.78.

The braking can be accomplished either by a hand or an electromagnetic brake similar to the General Electric brake, well known in America. The necessary current is

furnished by the motors, which are momentarily transformed into generators. The electrical braking of the trailers is accomplished by the current acting on an iron core, which, by means of a system of levers, operates the brake-shoes of an ordinary hand-brake. The latter can, however, also be operated by the motorman without affecting the electromagnetic device, so that these cars can be used either as horse cars or trailers.

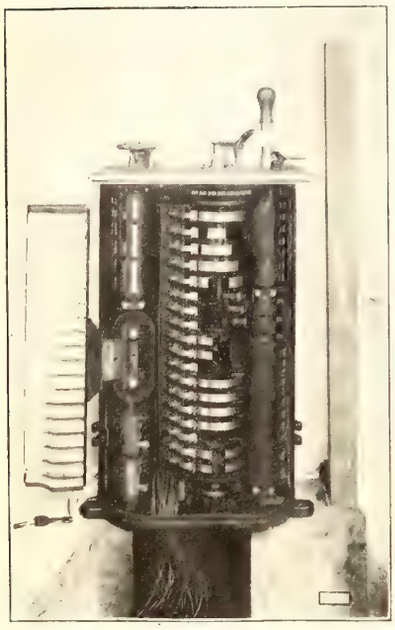


FIG. 10.—CONTROLLER WITH ELECTRIC BRAKE ATTACHMENT

The controllers for the simple trolley cars are of the series-parallel type, with electric brake attachment. Those for the mixed system cars are provided with a supplementary cylinder and small hand-wheel, by means of which the following combinations may be obtained:

1. The motors are connected with the trolley and the battery is being charged.
2. The motors are connected with the trolley and the battery is cut out.
3. The battery is connected with the motors and the trolley is cut out.

The trolley-pole is of the standard under-running type. In cars designed for the mixed system the pole may be let down onto the roof of the car.

The accumulators of Majert type, which were nearly all furnished by the Accumulatoren-werk Oberspree Niederschönweide, are situated under the two rows of seats in the cars. The first batteries were furnished by the Accumulatorenfabrik A. G., Berlin. The cells are provided with slugs, by means of which they are singly suspended on a wooden strip, which is a part of the car-body, and which is covered with hard rubber. Spilt acid can run off freely through openings in the bottom. Air is admitted into the accumulator space through four ventilating pipes in each corner of the car, which lead up through the roof and there end in a suction head. The double-truck cars contain 200 cells, which can furnish 30 amp.-hours at a one-hour discharge, and the single-truck cars contain 200 cells, having a capacity of 25 amp.-hours also if discharged in one hour. Although the longest portion of the road, along which there is no overhead trolley, is only 5 km (3.1 miles), the large types of accumulators have been chosen, as smaller ones would soon go to pieces, due to the large charging and discharging currents and the current consumption, which rises to a considerable amount during unfavorable weather conditions. The time for charging varies according to the time during which the battery was last discharged, from three to ten minutes. The charging current is 180 amps. at the beginning, dropping quickly to 100 amps., and then gradually decreasing in a straight line to 5 amps. The discharge current has an average value of 40 amps., but rises at times to 250 amps. These values relate to the larger types; for the smaller types the currents are about 70 per cent of the above. An ammeter is placed in the accumulator circuit, which shows whether the battery is charging or discharging.

FIG. 11.—PASSING UNDER BRIDGE WITH 14 FT. 10 INS. HEADROOM

There are ten incandescent lamps to furnish light in the cars connected in series of five each. They are supplied with current from the battery, 170 cells being necessary for that purpose when the trolley is in use, all of them, however, when they are being discharged.

The large cars have seats for twenty-eight, the small ones for twenty passengers, and there is standing room in each car for twelve people. All cars are equipped with a sand-box, and in the newly equipped cars the sand is thrown in front of the two forward wheels.

The first motor-cars were stored in the old, renovated car houses of the company, in the Manteuffel and Münberg Streets. In 1897 the depot in the Brandenburg Street was torn down and in its place a modern car house holding sixty-three motor-cars, and a small repair shop, was erected. During the course of the last few years a large part of the car stables were transformed into motor-car houses, and several new depots, designed exclusively for motor cars, have been constructed. A larger repair shop, in which one hundred cars may be repaired and 150 more stored at the same time, has been built in Ufer Street, where the new cars are also equipped with motors. In this connection it might be stated that the depots, which at the beginning of 1899 offered room for nearly 1100 horse cars and 6000 horses, will, within one and one-half years, all be transformed into houses for the housing and repairing of motor-cars. By the time the work of transformation is completed the company itself will own in round figures 1200 motor-cars, to which should be added one hundred motor cars belonging to other companies.

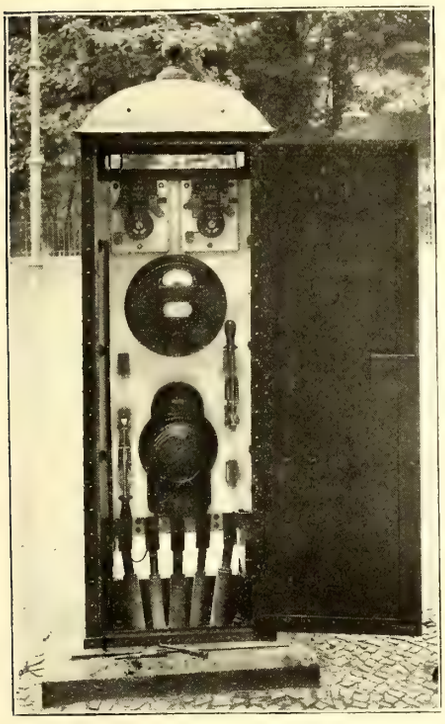


FIG. 12.—SECTION BOX WITH TWO WATTMETERS FOR MEASURING CURRENT FLOW FROM FEEDERS TO TROLLEY

In Berlin it is difficult to talk about a center of traffic; the various squares and markets rival with each other to become the most popular. Take, for example, the Alexanderplatz, from which emanate and through which cross twenty car lines with 150 cars an hour. A plan of this square is shown in Fig. 9 and a view of it in Fig. 2.

The Vincennes Exposition Railroad

[*From Our Regular Correspondent.*]

The Paris Exposition is divided, as most readers of this paper know, into two sections, this arrangement being determined upon by reason of lack of available space within the city limits. The annex is situated at Vincennes, about 6 miles distant from the main grounds, and is practically isolated, inasmuch as there is no adequate system of transportation between the two sections, and a single entrance ticket will not give admission to both. A partial solution of the transportation problem has been secured by providing a "temporary" double-track trolley road, which follows the line of the fortifications past the Bois de Vincennes, branching out into a loop at the main entrance to the Exposition grounds, and forming connection at one end with the Nogentais tramway system and at the other with the river steamboats. This line has been constructed by the French Thomson-Houston Company, under the supervision of its engineer, A. N. Connett, and was put in operation for the first time on May 12. It is doubtful whether it will be a paying property at first, as the Vincennes annex gives but little indication of becoming a really popular resort. The track races will doubtless draw a crowd; but during the show there will always be a

FIG. 2.—VIEW SHOWING POLES

FIG. 1.—TERMINUS OF VINCENNES ROAD AT ENTRANCE TO TRANSPORTATION EXHIBIT

general tendency on the part of the public to spend their time at the main Exposition grounds, where side shows and other amusements abound. The transportation and machinery exhibits are exceedingly interesting from an engineering and educational point of view, and the question has been raised as to whether it would not have been more just to exhibitors and to the thousands of visitors interested in these matters to have allotted space for such exhibits within the Champ de Mars grounds, instead of de-

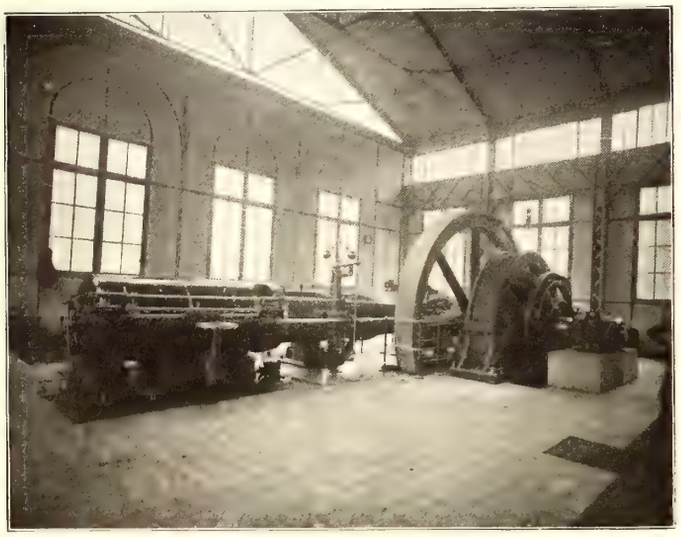


FIG. 3.—INTERIOR OF ENGINE ROOM

voting a large area to side shows and subordinating the true object of the Exposition to an apparent desire for pecuniary profit on the part of the administration.

The new electric line just inaugurated is intended as a connecting link between the Exposition annex and the various tramway lines which bring visitors to the city gates in the southeastern district, as, up to the present, there has

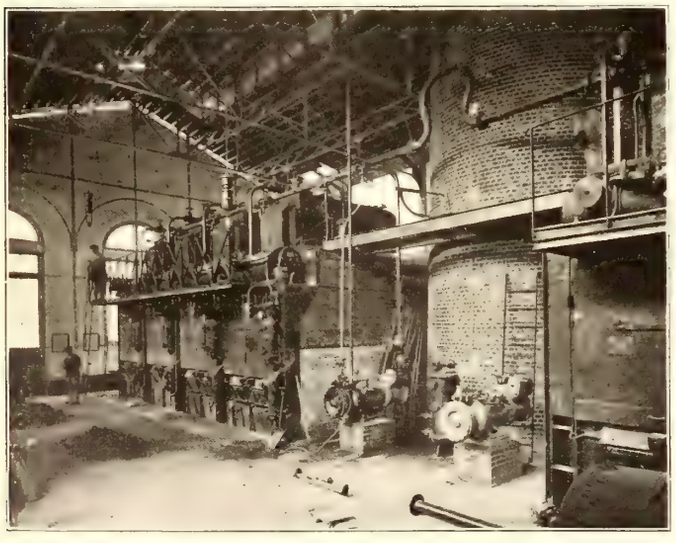


FIG. 4.—INTERIOR OF BOILER ROOM

been no street car service to the gate of Reuilly, where the main entrance to the Exposition of Vincennes is located. The cars are double-deck. It is intended to put twelve into service later on, but six only are used at the present time, as the line is less than 2½ miles long, and very few passengers are carried. On May 12, which was a Saturday, and, as above stated, the opening of the railroad to public use, the paying entries to the annex were only 759 for the entire day. Sunday brings out the crowds in every part of the city, and the paying visitors to Vincennes numbered on the 13th 6865, but it is doubtful whether there will be much passenger traffic on the new road on week days, at any rate until the season is further advanced.

The only point where the railroad passes outside the fortifications is at the gate of Reuilly, where a wide loop is made in front of the Exposition entrance. Fig. 1 shows one of the cars standing on the track at this curve, the entrance gateways being on the left and the Exposition buildings in the background. The roofed steel structure is the railroad depot where goods for exhibitors were unloaded; in the distance can be seen part of the Transportation Building, in which are the various types of locomotives built by French and foreign companies. Off to the right is the American Machinery Building. A double track is used on this loop, but the cars pass over both tracks in the same direction, the two lines being provided for the purpose of expediting the service at the gates, while two single tracks are laid in the cut-through fortifications.

A temporary car house has been erected near the upper end of the line, capable of affording sufficient shelter to the cars during the Exposition months. Near this building the track runs up a steep incline (Fig. 2), following the

FIG. 5.—CAR NEAR CITY WALLS

wagon road, and further on crosses the steam railroad of Vincennes, which has a station at the Place de la Bastille.

The trolley wire is carried on side poles, with flexible brackets. A large extension of the railroad system is contemplated, and for this purpose a larger power station is being built than would be necessary for this temporary line. The station is located near the northern terminus, in Rue des Laitières, where there are installed two 500-hp single-cylinder engines by Weyher & Richemond, running at 90 r. p. m., and two 1000-hp cross-compound engines by Farcot, of St. Ouen, running at 92 r. p. m. The generators are built by the Postel-Vinay Company for the French Thomson-Houston Company. Those coupled to the single-cylinder engines give an e. m. f. of 550 volts, and these machines are used for the temporary railroad. The larger generators furnish current at 750 volts, and are intended to supply power for the distant points of the Nogentais system, but motor-generator sets are provided, for cases of emergency, to transform the current from the higher to the lower voltage, or vice versa, as may be required. The two smaller engines are already in running order, but their condensing apparatus is not yet in use, owing to lack of water. An artesian well is being sunk just outside the power house, but up to the present time the

heavy clay bed has not been pierced, although a depth of over 300 ft. has been reached. The condensers are located below the engine-room floor, on the ground level.

Both types of engines in this station are represented at the main Exposition in the Champ de Mars Machinery Building, where Weyher & Richemond have two engines of 1000 hp, and one of 500 hp, and Farcot one of about 850 hp. The former company makes use of a very peculiar valve gear, which has apparently not the quality of simplicity, although at first sight there seems to be but little complication. The steam pressure is about 114 lbs. per square inch in the valve chest of this engine, and for the Farcot cross-compound about 128 lbs. in the valve chest of the high-pressure cylinder.

The boiler room immediately adjoins the engine room, and contains two batteries of four boilers each. Belleville water-tube boilers are employed, with automatic feed-water supply and one feed-pump per battery, these being placed on special masonry foundations between the two sets of boilers, at the base of the smoke stack, which is carried through the roof. Economizers placed above the boilers heat the feed-water as it passes from the pump. Steam is kept at a pressure of about 240 lbs. per square inch, in the boilers, and is held in auxiliary reservoirs in order to provide for fluctuations in load. This high pressure effects a considerable saving in space, as a low pressure of steam would require larger boilers; beneath the engine-room floor reducing valves are provided for bringing the pressure down to the required amount.

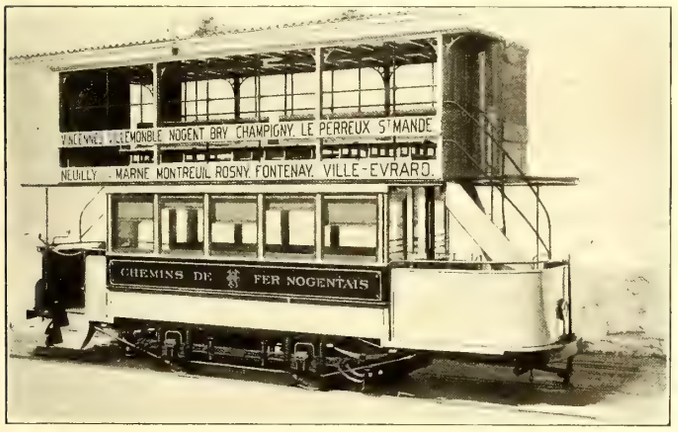
Behind the station are being erected two cooling towers, where the warm condensing water, falling in a shower from above and passing through a network of wooden rods, is cooled sufficiently to use over again.

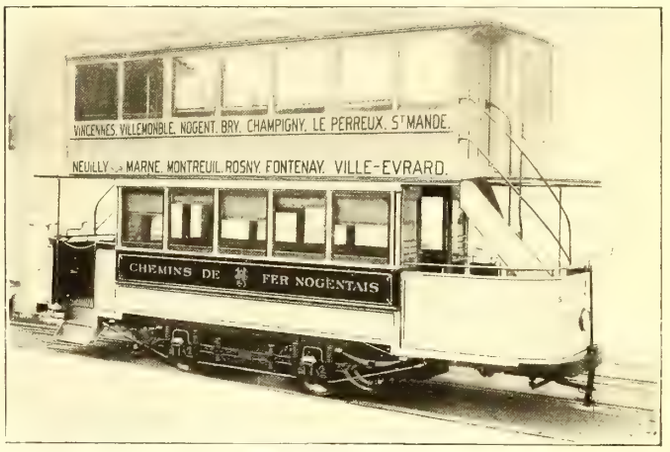
The station is favorably located for furnishing power to the system it is intended to supply, being near the city limit and not too far from the center of the suburban lines. The switchboard, in addition to its four generator panels, will have thirteen feeder panels, supplying current to close upon 40 miles of track.

As the cars are of a somewhat novel type a few words of description will be of interest. Those used on the Vincennes line are of the double-decked type with bodies 14 ft. 11 ins. over all and inside 14 ft. $2\frac{1}{2}$ ins. The platforms are a trifle more than 6 ft. in length, making the cars measure about 27 ft. over the dashers. They are mounted on No. 21-E Brill trucks with a 7-ft. wheel base and have two G. E. 58 motors. These cars were fitted so they would be able to draw a trailer.

In the lower compartment longitudinal spring seats covered with plush are used. The brass arms divide the seats into spaces, two of which have room for two sittings and the remaining one for three. In respect to the space allowed to each person the French regulations are extremely minute and particular. A small fraction of an inch below the required amount reduces the licensed number of passengers. On the lower deck 480 mm, or 18 29-32 ins. are allowed for each individual, the measurements going from center to center of seat arms. Upon the upper deck 460 mm or 18 3-32 ins., are allowed per person. Although the French are as a race smaller than Americans, the space required in their regulations is considerably greater than that considered necessary in America.

The sash of the lower deck drop and the windows are protected by spring roller curtains. The platform is unusually large and the opening is in consequence quite narrow. The dasher closes one side of the platform com-


VINCENNES, VILLEMONBLE, NOGENT, BRY, CHAMPIGNY, LE PERREUX, ST MANDE.
NEUILLY MARNE, MONTREUIL, ROSNY, FONTENAY, VILLE-EVRARD.
CHEMINS DE FER NOGENTAIS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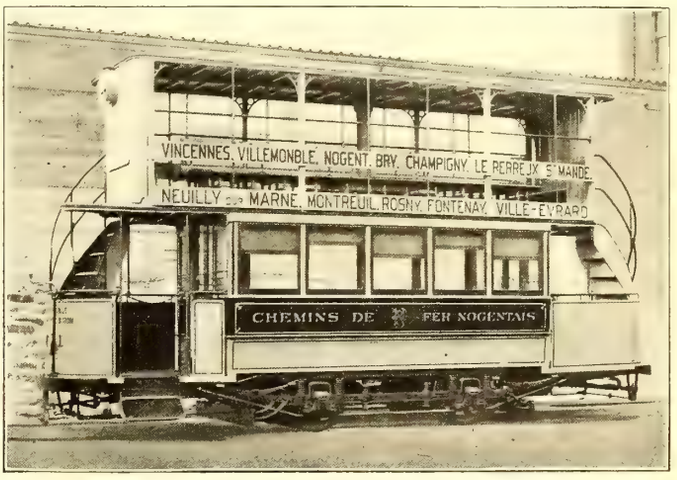
CHEMINS DE FER NOGENTAIS

VINCENNES, VILLEMONBLE, NOGENT, BRY, CHAMPIGNY, LE PERREUX, ST MANDE.
NEUILLY SUR MARNE, MONTREUIL, ROSNY, FONTENAY, VILLE-EVRARD.
CHEMINS DE FER NOGENTAIS


VINCENNES, VILLEMONBLE, NOGENT, BRY, CHAMPIGNY, LE PERREUX, ST MANDE.
NEUILLY MARNE, MONTREUIL, ROSNY, FONTENAY, VILLE-EVRARD.
CHEMINS DE FER NOGENTAIS

FIGS. 6-9.—VIEWS OF CARS, SHOWING UPPER DECK OPEN AND CLOSED

pletely. The stairway is of the ordinary European type of sheet metal, but is made with a high rail so that accidents are not likely to occur. A projection of the upper deck forms a sort of hood over the motorman. The upper deck or imperial itself is a novelty in every way. As shown in Fig. 6, it will be seen that there is a substantial canopy supported on strong posts. These are reinforced by a light tubular railing. For summer work the imperial or upper deck is open as usual. It has longitudinal seats divided by bronze arms as in the space below. The seats themselves are of slats with open spindle backs. At each end is a bulkhead, part of which projects outward over the platform, and in this projection a space is found for a seat at each end accommodating two persons. The door, as will

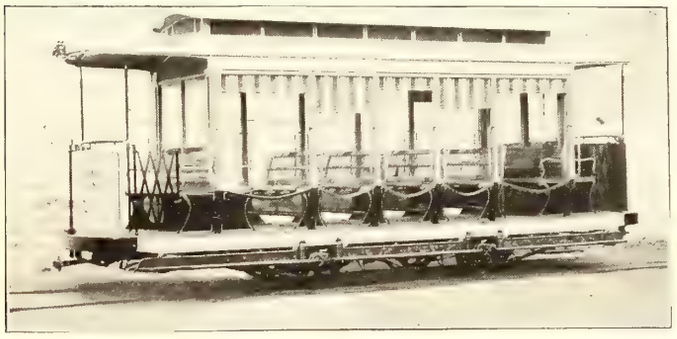


FIG. 10.—TRAIL CAR

be seen from Fig. 7, opens against the side of the car. This construction permits the seating of twenty-two persons on the upper deck, while but fourteen find seats below. The bulkhead is a valuable feature in the open car because it affords considerable protection in the case of wind or stormy weather.

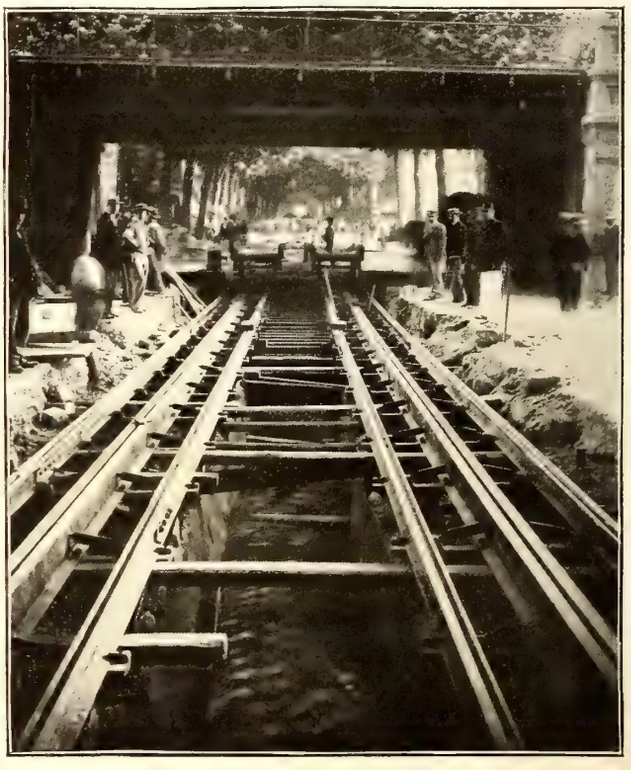
For winter service the whole imperial is enclosed by glass sash and panels as will be seen from Figs. 7 and 8. By the use of metal for panels the whole movable part is made very light so as to be easily handled, and is at the same time very strong. This form of construction, it is thought, has never previously been introduced. The metal for the panels is especially prepared and treated for this purpose. It makes the imperial quite as comfortable in winter weather as the other part of the car, and naturally increases its capacity. Beneath the seats on the upper deck a narrow monitor is introduced which increases the head room of the lower deck materially. One feature which will excite interest is the fact that the roof of the upper deck is made almost perfectly flat, and the trolley pole is carried by a light iron casting coming up from the main roof. This casting terminates in a bell, from which two gutters run to each end of the car. These gutters are seen in Fig. 6. In this the gutter can be seen in the center of the roof, the bell and the trolley tube being removed. In Fig 9 the tube is shown in place. Probably the practice is, when necessary, to pull the trolley pole down until it is flush with the roof. The long platforms are supported by angle-iron knees and the half elliptic springs on the ends of the trucks have a bearing not only on the body but on the platform. The truck with the motors weighs 9275 lbs., but the total weight of the car is only 18,825 lbs.

Apparently head room is at a premium, for these cars are scarcely high enough for an ordinary man. A six footer, even without his hat, has to stoop to pass into the imperial. The actual height in the clear is 5 ft. 6½ ins. On the lower deck it is 5 ft. 7¾ ins. The total height of the car from the rail is but 14 ft. 5¼ ins. With 33-in. wheels the platform is brought within 28 ins. of the head of the rail.

The trailers for these peculiar cars are not unlike those used in America on horse car lines, and are shown in Fig. 10. They are of the eight-bench open type mounted on Brill trail gear. The width in this case is so limited that it became necessary to introduce the peculiar form of grab handle shown. These are made in such a way that they do not extend outside the posts. The cars are 22 ft. 11 ins. long, have 4-ft. platforms and measure about 30 ft. over the dashers. Their width at the sills is but 5 ft. 7½ ins. and the seats are 5 ft. 11 ins. in the clear. The wheel base in this case, as in the other, is 7 ft. The seats are slat with open backs having ash spindles. The inside finish of the car is cherry with three-ply quartered oak head lining. The total weight of the car is only 7160 lbs. From the top of the sill to the step is but 13 ins., and the distance from the head of the rail is only a little greater.

Tramways of Nice and The Littoral

The towns along the Riviera from Cannes, France, to Menton, are being connected by an electric road. The entire system is being installed by the French Thomson-Houston Company, of Paris, which is directing all its energy toward completing the line at as early a date as possible. A 10,000-volt transmission line from Mescla, 30 km (18 miles) inland, supplemented by a steam plant



CONDUIT CONSTRUCTION AT NICE

at Nice will supply the power. When finished there will be 150 km (63 miles) of single track included in the street lines of Nice and the stretch of 50 km (31 miles) along the coast.

The former horse car system of Nice has been greatly extended and new lines have been added in and about the city. In the central portions, and especially on such streets as are traversed by the parades of the annual carnival, it has been thought desirable to build an underground conduit, but everywhere on the outskirts of the city the overhead trolley is used. The cars are adapted to travel over either system.

The construction of the conduit was delayed by last

winter's season, during which no work was allowed in certain sections, but it has since been pushed ahead night and day and, notwithstanding the numerous points where crossings of the lines occur with their accompanying elaborate special work, is almost entirely completed. The conduit is similar to the one built by the Thomson-Houston Company in Lyons and on the line from the Bastille to Charenton in Paris * and is well illustrated in the reproductions of the photographs taken during construction, which accompany this article.

Special attention has been given to the construction of the overhead line, the trolley wire running over the middle of the track as on American roads. The wire is 8.25 mm in diameter (No. 0 B. & S.) and supported either by means of transverse span wires or on long brackets from the poles. These latter are of the tubular type, but are so ornamented as to give quite a graceful appearance. In the city, wherever it has been possible, the use of poles has been dispensed with and the span wire has been attached to rosettes on the walls of the houses along the street.

The lines outside of Nice consist of the main line, which, starting from Cannes, traverses the cost to Menton, passing through Californie, Nice, Villefranche, Monte Carlo, etc., and by Cape Martin; and a branch line between Nice and the inland village of Contes. The latter is completely finished and will soon be in operation.

The Compagnie des Tramways de Nice et du Littoral, which is the operating company, has also secured the exclusive right to use the lines of railway recently built in Monte Carlo and described in the May issue. Menton, where the installation was last taken up, is expected to have cars in operation by the coming winter.

Double track is used entirely in Nice itself, but single track with turnouts is found at places along the coast. The gage is 1 meter. The rails are of the Broca or grooved girder type with a deep groove, and weigh 45 kg per meter (90 lbs. per yard). They are generally set on concrete and the joints are welded together by the Falk process. Granite blocks from the quarries of Saint Raphaël are used for paving.

The equipment of the power station at the Falls of Mescla consists of three 500-kw generators, each connected by a flexible coupling to turbines. The generators are twenty-pole, three-phase machines with stationary armatures and internal, revolving poles, having a frequency of 25 cycles per second and an electro-motive force of 10,000 volts.

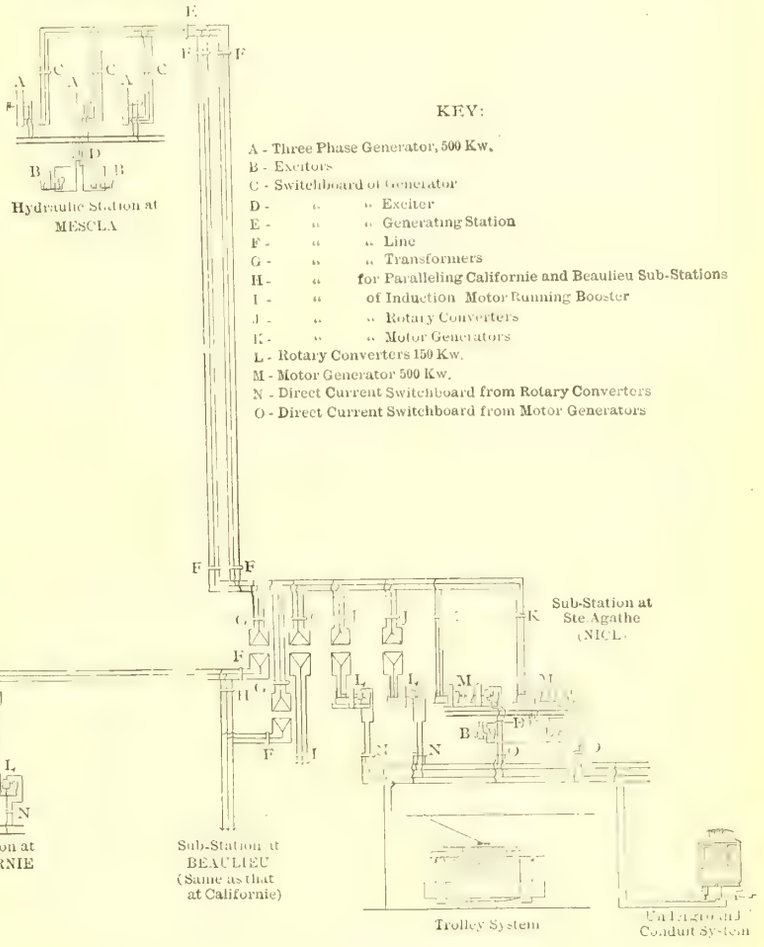

KEY:
A - Three Phase Generator, 500 Kw.
B - Exciters
C - Switchboard of Generator
D - " " Exciter
E - " " Generating Station
F - " " Line
G - " " Transformers
H - " for Paralleling Californie and Beaulieu Sub-Stations
I - " of Induction Motor Running Booster
J - " " Rotary Converters
K - " " Motor Generators
L - Rotary Converters 150 Kw.
M - Motor Generator 500 Kw.
N - Direct Current Switchboard from Rotary Converters
O - Direct Current Switchboard from Motor Generators
Hydraulic Station at MESCLA
Sub-Station at Ste Agathe (NICE)
Sub-Station at CALIFORNIE
Sub-Station at BEAULIEU (Same as that at Californie)
Trolley System
Underground Conduit System

DIAGRAM SHOWING TRANSMISSION SYSTEM

SUB-STATION AT NICE

On the 30-km transmission line connecting the Mescla station and the principal sub-station at Nice, there is a drop of 10 per cent. At Nice a portion of the current is transformed to 5000 volts, and retransmitted to two other sub-stations, one at Californie for supplying the line to Cannes and the other at Beaulieu for supplying the line to Monte Carlo.

As already mentioned, the sub-station at Nice contains the auxiliary steam plant. This includes two 700-hp double cylinder Corliss engines belted to the motor generators and two batteries of four boilers each. The latter are semi-tublar, having a heating surface of 185 sq. m (1991 sq. ft.) and a capacity of 20,000 kg (44,000 lbs.) of steam per hour. The diameter of the engine cylinders is 50 cm (19.68 ins.) and the stroke 1.21 m (47.64 ins.) They run at 100 r. p. m. There are two feed-pumps, one simple and the other compound, and a feed-water heater which uses the exhaust steam. The steam piping is mostly cov-

* See STREET RAILWAY JOURNAL, December, 1899.

ered with a non-conducting packing and the steam pressure is 10 kg per sq. cm (142 lbs. per sq. in.) There are two brick chimneys, one for each battery of boilers, 40 m (131 ft.) high and 2 m (6.56 ft.) internal diameter at the top.

POLE WITH LONG BRACKET

The illustration of the sub-station's interior shows the manner in which the engines are belted to the motor generators. These are two in number and consist of a 530-kw synchronous motor direct connected to a 500-kw compound railway generator. The synchronous motor receives the current directly from the Mescla transmission line at a pressure of 9000 volts. The generator has an e. m. f. of 500 volts at no load and 550 volts at full load. The speed is 300 r. p. m. The four-pole exciter for the motor, seen belted to the common shaft, is a 25-kw, 60-volt machine turning at 1100 r. p. m. There is one for each group of motor generators.

There are also in this station two rotary converters, for which the required e. m. f. of 340 volts on the alternating side is obtained by means of six static transformers. The three-phase transmission to Californie and Beaulieu at 5000 volts is supplied by six 55-kw transformers in two sets of three each. These lines may either be run entirely separate or thrown in parallel. Three 20-kw transformers reduce the pressure to 110 volts for running a small motor generator. This consists of a 50-hp induction motor, coupled directly to a 35-kw multipolar dynamo. The e. m. f. of the latter at 750 r. p. m. is 75 volts, and it is used as a booster on the line running to Contes. Oil insulation is used in the transformers.

The switchboard, part of which can be seen in the illustration, has altogether twenty-five panels. The principal ones are given in the diagram of circuits which accompanies this article, so that a detailed description is unnecessary. The arrangement of the instruments, etc., is according to standard practice. All connections are made by insulated cables on special porcelain insulators.

The machines are designed for a rise in temperature of 45 degs. C. (113 degs. F.), but will stand an overload of 25 per cent for half an hour, and one of 40 per cent for a few minutes without overheating or mechanical strain.

The station is lighted by direct current enclosed arc lamps on a 120-volt circuit. The current is obtained by using a 20-kw motor generator to reduce the pressure from 550 volts. This machine has a speed of 875 r. p. m. and is composed of a 550-volt motor direct coupled to a compound-wound dynamo.

The sub-station at Californie and Beaulieu, whose equipments are identical in all respects, are connected with the main sub-station at Nice by lead covered cables running in an underground conduit. These cables contain three wires, each 30 mm² in cross section (between Nos. 2 and 3, B. & S.) which transmit the three-phase, 5000-volt current from Nice. The sub-station at Californie is completely installed. The equipment consists of two 150-kw rotary converters and six 55-kw static transformers for reducing the pressure of the transmission line from 4300 to 340 volts. The rotaries have a speed of 750 r. p. m. and are 10 per cent over compounded. The switchboard has five panels, four of which are shown in the diagram. The one omitted is the line panel.

The feeders are nearly all underground. About the only exceptions are along the Contes line and for a short distance from the sub-station at Beaulieu—perhaps 10 km altogether. These overhead feeders are carried on the same poles as the trolley wire. They are 125 mm² (.194 sq. in.) in cross section. The underground system is made of armored cable 200 mm² to 400 mm² (.31 to .62 sq. in.) in cross section, which is carried from the sub-station to the points of distribution by the shortest possible paths. In order that the municipal regulations regarding difference of potential between the track and underground pipes may be strictly adhered to, a complete system of voltmeter or "pilot" wires has been designed and connects all the important parts of the line with the station switchboard. All danger from electrolysis is thus practically avoided.

When completed one hundred motor cars will be operated on the road, and if the service demands it, as many trailers as necessary. Twenty-two express or freight cars

LAYING A PART OF THE CONDUIT SECTION

and three electric locomotives will also be used. The motor cars are made in three models; those with but one compartment, those with two, for first and second class, to be used on the interurban line, and special parlor cars.

The electrical equipment of the cars consists of two G. E.-58 motors and electric brakes, controlled by B.-24 controllers placed at each end of the car. The cars are furnished with both trolley arms and underground contact plows so that they may be run at will over any part of the entire system.

CORRESPONDENCE

The Need of Heavier Wheels

BUFFALO, June 18, 1900.

EDITORS STREET RAILWAY JOURNAL:

We wish to call attention through the columns of your paper to a matter of importance in the service of wheels on electric street railways.

Owing to the increase in traffic, a number of roads in the larger cities have been rebuilding their equipment, using parts of the old equipment in the new construction. In the case of wheels and axles the lighter sections used under the cars and equipment are inadequate for the service demands of the new construction, even when eight wheels are used under one car, instead of four, as formerly, the new cars being, as a rule, longer than the old ones, and the use of eight wheels being necessary on account of the introduction of double trucks.

The additional strain imposed has been recognized in the case of axles by the substitution of axles 4 ins. and over in diameter, where formerly $3\frac{3}{4}$ ins. was the largest size used, but the weight and section of the wheels have not been correspondingly increased, and in fact have been practically decreased by the extra strain imposed in pressing them on the larger axles, which, of course, necessitates boring them out larger, and hence leaving less metal in the hub to resist a greater strain.

We are recommending a weight of not less than 400 lbs. for wheels 33 ins. in diameter, used under equipment where 4-in. axles and over in diameter are used. This allows for an increase of 25 per cent in the section of spokes and web, as compared with the 33-in. 360-lb. wheel that has been the standard for the past five or six years, but this increase of 25 per cent in the section only adds 10 per cent to the weight of the wheel, and as the railway company obtains increased scrap value from the additional metal the cost of the wheel is not materially increased.

It may be argued by managers of electric railways that the present section seems to be sufficient for the needs of service, and that a change might be considered when it proved insufficient, but this seems hardly a wise view to take if accidents are to be avoided. The conditions of service which may not cause accidents under ordinary temperatures are most likely to do so under continued low temperatures, and it is necessary to provide for maximum conditions, no matter how seldom they may occur.

There can be no doubt that the factor of safety has been decreased by the increase in the weight of equipment and speed at which electric cars are operated.

We are prompted to write you on these points in view of what appears to us as the great need of keeping the quality and character of the wheels for electric service up to the increasing demands of this service.

We believe that the officials of electric railways are in favor of such progress, but it is a question whether in the press of other matters they are always able to give the necessary time to this particular subject, and to appreciate the importance of it.

NEW YORK CAR WHEEL WORKS,
Pemberton Smith, Engineer.

Polyphase Transmission for Electric Railways

PITTSBURGH, Pa., June 18, 1900.

EDITORS STREET RAILWAY JOURNAL:

The following electric railways should be added to the list contained in your issue for June 2, as using polyphase apparatus for power transmission:

Name of company	Power transmitted
Long Island Railroad Company (Far Rockaway branch)	267 hp
*Sanford & Cape Porpoise Railway Company, Sanford, Me.	667 hp
Utah Power Company, Salt Lake City, Utah	2000 hp
Youngstown Park & Falls Street Railway Company, Youngstown, Ohio	533 hp

*Uses a 500-kw double-current generator.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.

Electric Heaters

NEW YORK, June 12, 1900.

EDITORS STREET RAILWAY JOURNAL:

We have noted in your June number an editorial on the subject of electric heaters for street cars. We must take exception to some of the statements made, as we have placed upon the market during the past five years nearly 50,000 electric heaters, but up to the present time we have never heard of one single instance where a Gold electric heater has burned or even scorched a dress; neither is there a record of any one of these heaters ever having short circuited or given trouble in any way.

In the Gold electric heater the circulation of air through the resistance coils is so rapid that the flow of warm air from the top of the heater, while large in volume, is moderate in temperature, and is never so intense as to unduly heat the front casing. In regard to short circuiting, one look at the construction of the Gold electric heater will thoroughly convince any one that it is absolutely impossible for a short circuit to take place within the heater, for the reason that the resistance coils are supported in such a way that should any accident occur, it would be impossible for them to leave their supports.

The place for an electric heater in a street car is just where the great majority have been applied, that is under the seats and set back into the panel board. A heating system like the one suggested in your article, intended to carry the warm air up back of the seats and heat the windows and incidentally the necks of the passengers, leaving their feet cold and the floor of the car wet, would be entirely impracticable. The consumption of current in electric heaters has been reduced to such a point that railway managers on all of the large systems throughout the country appear to be entirely satisfied on this point.

We might add that in a test recently made with our Gold improved electric heater an overload of 25 per cent was put through the heater, and the casing was entirely covered with damp cloths. The current was left on then one full hour, and at the end of that time there was not the slightest indication of burning or discoloring in any way.

No heater in actual practice is ever put to such a severe test as the one mentioned. It simply shows that when our heaters are used, no fear need ever be entertained of burning the clothing of the passengers or of the heater coils short circuiting.

GOLD STREET CAR HEATING COMPANY,
By Edward E. Gold, President.

STREET RAILWAY JOURNAL

JULY 7, 1900.

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Special effort will be made to answer promptly, and without charge, any reasonable request for information which may be received from our readers and advertisers, answers being given through the columns of the JOURNAL *when of general interest, otherwise by letter.*

Street railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our news columns.

All matters intended for publication in the current issues must be received at our office not later than Wednesday of each week.

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Beard Building, 120 Liberty Street, New York.

The equipment of towns and cities with the trolley system of tramways in England is certainly eliciting a great deal of attention from the residents. An interesting letter regarding the color of the poles from a writer signing himself "Artist" has recently been published in a paper of a town whose roads have lately been electrically equipped. This artist calls attention to the color of the poles, and advocates a grey-blue color as being particularly suitable for the purpose on account of its being what he calls a "retiring" color. At the same time he also advocates painting the cross arms blue, as they are often seen against the sky, and will be less noticeable if painted this color. He also points out that in many of the streets in his town the houses are of red brick, and that perhaps in that part of the city the poles might be painted a similar color. It is curious to note the interest which these details have elicited, though we are of opinion that the various colors which this artist suggests, instead of making the poles less conspicuous, would have the very opposite effect, and we think that this may be safely left to the engineers in charge of the work, who undoubtedly are familiar with the proper colors to give poles from their experience in other towns.

It appears that Russia is to be invaded by American manufacturing capital, which will shortly establish large plants for the production of electrical apparatus, pumps, sewing machines and other American machinery of all kinds. The value of American special machines in reducing the cost of manufactured product is coming to be generally recognized in European countries, as can hardly fail to be the case, considering the enormous difference in costs brought about by their use.

We chronicle elsewhere the establishment by the employees of the Camden & Suburban Railway Company of what has been called a "Discussion Night," to be held once a month. The plan has the cordial co-operation of the officers of the railway company, who have presented a room to the employees for holding their meetings. This plan, which we think has been, and is, in operation on a few other roads in the country, of meeting once a month and discussing problems in electric railroading, is a most desirable one. The association not only proposes to discuss electrical and mechanical problems, thus making the operation of electrical apparatus much simpler to the user, but also to take up the operating problems upon which there is much less literature or opportunity to study from text-books than in electrical apparatus.

The general practice in steam engineering in this country is to depend entirely on the cut-off, as controlled by the governor, to vary the admission of steam in the cylinder with changes in the load. In this respect American practice differs from that in England, and in some other foreign countries. There, throttling for low loads is extensively practised. That is, the cut-offs of the engine are controlled in the usual way, but where the engine is running considerably under load the throttle is partly closed by the man in charge. It may be news to some of our readers to learn that this practice, especially with compound engines, has given a very high efficiency, as compared with engines operating under full steam pressure with all loads. There are several reasons for this. In the first place, with a fluctuating load such as in street railway service, it is exceedingly difficult, with full steam pressure, to maintain an equality in load between the high and low pressure cylinders at low loads, consequently the low pressure cylinder becomes a drag on the engine. Again, where throttling is practised, the steam after passing the throttle, is in a certain sense superheated. That is, while its temperature may not be higher than that before it passes the throttle, there are more heat units in the steam than are required for saturated steam at the lower pressure at which it is admitted to the cylinder. This fact adds to the economy of the engine in producing less cylinder condensation, which is a considerable loss in all engines. Again, the differences in terminal temperatures in the high-pressure cylinder at low loads will be less, in which case we should expect to obtain better steam consumption results. These arguments, at any rate, are those used by the advocates of throttling. While the advantages may seem somewhat hypothetical, it is interesting to note that the method is being tried in this country. In one station, for instance, the equipment consists of a number of 300-hp high-speed engines, each belted to a generator, and one 1250-hp direct-connected compound Corliss engine. Ow-

ing to its lower economies at low loads, the all-day efficiency of the 1250-hp engine has been found to be 10 per cent less than that of the 300-hp engines, which, owing to their small size, can be thrown in and out of service as required, so that those running can be worked up to their full rating continuously. The owners of this station are going to try throttling the large engine at low loads, and hope to obtain better results.

The decision by the managements of the Boston Elevated Railway Company and the Manhattan Elevated Railroad Company, of New York, to adopt the multiple unit and double unit systems, respectively, for the operation of trains on their elevated roads, probably sounds the knell of the "locomotive" for high-speed city and suburban transportation, both in this country and abroad, and it is safe to say, we believe, that nothing but distributed motor systems will hereafter be considered, unless by ultra conservative or poorly informed engineers and capitalists. The chain of logical sequence in arriving at "distributed motor" systems as the only solution to the rapid-transit problem is as follows:

1. The conditions are that immense numbers of passengers must be moved at the highest possible speed, on trains which follow each other as closely as is consistent with safety, over lines where stations are close together.

2. To produce high speed under these conditions, rapid acceleration is a necessity.

3. The rate of acceleration is limited by the "traction" of the driving wheels. This "traction" can be increased by increasing the weight on a small number of drivers, or by increasing the number of drivers.

4. The limits of possibilities on the first, or locomotive, plan are soon reached—by the second, or distributed motor plan, the limits are far ahead of the necessities, since 100 per cent of the train weight can be placed upon the drivers if desired.

5. With modern rapid transit, the locomotive system is and will be a failure. The distributed motor system, on the contrary, can, and will, revolutionize city traffic.

6. Incidental savings and advantages of great aggregate value are also found in the improved system—such as economy in switching, ease in maintaining schedules, simplicity in running branch line service without transfers, and economy in current consumption.

During the past two years the opinions of engineers have been completely reversed, and those who laughed at the idea of there being any economy or advantage in the distributed motor systems are now their most ardent advocates.

The world is now witnessing in Paris the complete paralysis of a city transportation system twenty years behind the times, and which, under the strain of a temporary increase in traffic due to the Exposition, has wholly broken down. This result is due less to lack of enterprise on the part of private capital than to absurd "regulation" and obstacle making by the French national, and the Parisian local governments. These have made determined and hitherto successful, opposition to the one great improvement—electric traction—which would make it possible to carry ten passengers in Paris where one is now accommodated. Does this seem an exaggeration? We have only to point to the history of transportation in New York City during the past twenty years to see how tremendous has been the increase in carrying capacity which electricity has brought. We could forgive Paris, however, for her "conservatism" in not permitting electric railways to invade her streets, particularly as the outside world shares in the beauty of Paris as it is, without suffering greatly, except for a few days or weeks in the year, from the inconveniences which Parisians themselves are forced to stand permanently; but it is more difficult to overlook the absurdity of the "*complet*" system which paternalism forces upon its sons and daughters in the mistaken idea that they are benefited thereby. As this "*complet*" system is occasionally held up in American city councils to the admiration of the people in an effort to further "no seat, no fare" ordinances, a few words as to how it works, both now and under ordinary circumstances, may not be out of place.

Imagine an omnibus or street railway route passing from the heart of Paris to a suburb, and lined with little waiting stations 500 to 1000 ft. apart. A bus takes its load at the city terminus, the passengers filling all its seats but five, let us say. Merrily it starts off on its journey, and in due course of time reaches the first waiting station. There it finds ten passengers anxious to embark. Each of the ten on entering the station has received a numbered ticket, and the five only who entered first out of the ten are permitted to take the bus. The load is then "*complet*," and a white card bearing that word is hung on the outside. If at the next station no one wishes to get out, the bus rolls on, leaving fifteen or twenty disappointed people in its wake, hoping that they may be more fortunate with the next arrival.

Now, in ordinary seasons, when no extra crowds are in Paris, a way passenger need not ordinarily wait more than from ten to twenty minutes on the less popular routes for the privilege of boarding a bus or car, and perhaps during the lighter traffic hours of the day not even so much. Now, however, it is a matter of hours, rather than of minutes, even to secure a seat at the city terminus of the suburban lines, while it is utterly impossible at almost any time to get on board at the way stations other than at transfer points. In a single case recently a trip to the Transportation Building at Vincennes, and return, required seven hours of waiting and riding together.

What wonder is it, then, that all Paris, native as well as foreign, has risen in arms against the transportation system, has mobbed the buses, the waiting rooms and the company's offices, has refused to submit to antiquated regulations, and is insisting upon better facilities. No such system would be tolerated in America for a moment, and if the experiment should sometime, by some mischance, be tried in an American municipality, the people would rise in their majesty after a day's experience of it, and would demand as a valuable privilege the right to again hang on to the much-abused strap, refusing utterly to wait even five minutes for a car which is not "*complet*."

The Starting of Rotary Converters

The increasing use of alternating-current transmission and rotary converters for the delivery of current to street railway lines warrants a discussion of the special problems of such work in these columns. The rotary converter,

while a most satisfactory machine when operating at full speed, is, so far as its alternating-current supply is concerned, a synchronous motor, and is consequently subject to the difficulties of starting inherent in this type of machine. Wherever possible, it is best to start rotary converters as direct-current shunt motors. This, of course, necessitates some source of direct current other than the rotary itself, since the latter will not transform alternating into direct current until it has reached full speed. With a storage battery such a source is always available, and with two or more converters in one sub-station any one can be started by means of direct current after any other is in operation. With continuous 550-volt copper from one station to another, the rotaries in a sub-station can be started up by direct current, transmitted from another sub-station or from the central power station over the trolley wires and feeders, the current drawn to start a machine at the sub-station not being sufficiently large to cause an excessive drop between stations if there are no cars on the line trying to start up at the same time. When starting up in the morning, if direct current is available at one station, this is a very satisfactory method, but if a shutdown occurs during the day this method of starting is likely to be interfered with by cars attempting to start up at the same time and pulling down the voltage at the unstarted sub-station to such an extent that the rotaries cannot be brought up to speed.

For starting by means of direct current there is required a starting rheostat in the circuit from the armature to the direct-current bus-bars, just as though the machine were a direct-current shunt-wound motor. Generally this starting rheostat is shunted around the negative main switch. In this case the negative terminal of the field of the machine should be connected to the negative bus-bar and not to the negative brush of the machine, so that the field may get full voltage before current is admitted to the armature. By closing the positive switch, the circuit breaker and the field switch, the field becomes excited, and by closing the path through the starting rheostat and cutting out resistance the armature is brought up to speed just as is any direct-current motor, after which the negative main switch can be closed, short-circuiting the starting box, and the machine can be synchronized and switched into the alternating-current circuits in the usual way.

Another satisfactory way of starting rotary converters is to switch them all into circuit before the main generator is started, and to excite the field of the latter to full strength before starting it, in which case the rotary converters will all speed up in synchronism with the main engine and generator. This requires that the exciter be separately-driven independently of the main generator. This method is applicable to starting up in the morning, but is, of course, not applicable to throwing on additional rotaries while the plant is running. In cases where there is a rotary converter in the central generating station this one rotary can be started up in the morning in this way, the others in outlying sub-stations being started by means of direct current from the central rotary transmitted over the trolley wires.

If it is necessary to start rotary converters with the generating plant running at full speed and with no direct current available, the above methods cannot be used and some means must be provided to start them by means of alternating currents at full frequency. In general, two methods are used. In one of these, a small starting motor of the alternating current induction type, which starts up readily from a standstill, is coupled to the shaft of each rotary converter. These starting motors bring the rotaries up to speed just as would any external source of power, the rotaries building up their own fields from residual magnetism, just as do any mechanical-driven direct-current generators. The rotaries are then synchronized and switched in to both the alternating and direct circuits in the usual way. Another method is to start the rotaries by switching the alternating currents into the armature through the usual collector rings, the fields of the rotaries being unexcited. A considerable rush of current follows, generally much more than full-load current, setting up induction-motor action on the field poles, which gives sufficient torque to overcome the friction of the machine and bring it up to speed. If alternating currents at full voltage are thrown on in this way, the rush of current is so great as to seriously pull down the voltage, unless the rotary is small as compared with the generator and line carrying capacity. For this reason transformers designed to give an extra low voltage for this purpose and termed "compensators" are usually put in.

The alternating currents in the armatures of the rotaries, when these are at standstill or are running at low speeds, set up alternating magnetism in the field magnets, inducing very high alternating e. m. f's. in the shunt-field magnet windings. The many turns of the shunt winding of a 550-volt rotary will receive such a high e. m. f. in this way that it is customary to use what is called a "break-up" switch to separate the several coils of the shunt-field winding from each other so that the voltages set up in all of the coils will not be added to each other to strain the insulation at the ends of the winding and cause a breakdown of the insulation and ground on the frame. The alternating magnetism in the field also sets up an e. m. f. in the series field coil, which tends to send a powerful current through the shunt round the series coil. To prevent this a switch is inserted in this shunt so that it may be opened at the time of starting.

This method of starting is perfectly satisfactory as long as the transmission line is supplying no other load calling for steady voltage. If the rotary converter to be started is a small one and the capacity of the line and generators is comparatively great, it works all right; but, otherwise, it overloads the line, and any other load upon it gets a bad drop of voltage. For this reason when there are two or more rotaries in a sub-station they should be fitted with direct-current starting boxes. With this means one may be started in the morning by means of alternating currents at a time when there is no load to be disturbed; the other or others may then be started by direct current without trouble from overload. If there are two or more sub-stations taking power from one generating station and the attempt is made to start up in the morning by means of alternating current applied to the rotaries at full frequency, one sub-station may be synchronizing and another will throw in and draw such an overload as to pull down the speed of the generator and prevent the first sub-station from getting in synchronism. A far better way is to either start all the rotaries with the generator or to start one rotary converter at one station by this means or even by the use of alternating current at full frequency, and from this rotary converter transmit direct current to the other sub-stations for starting purposes.

Transportation Building at the Bois de Vincennes

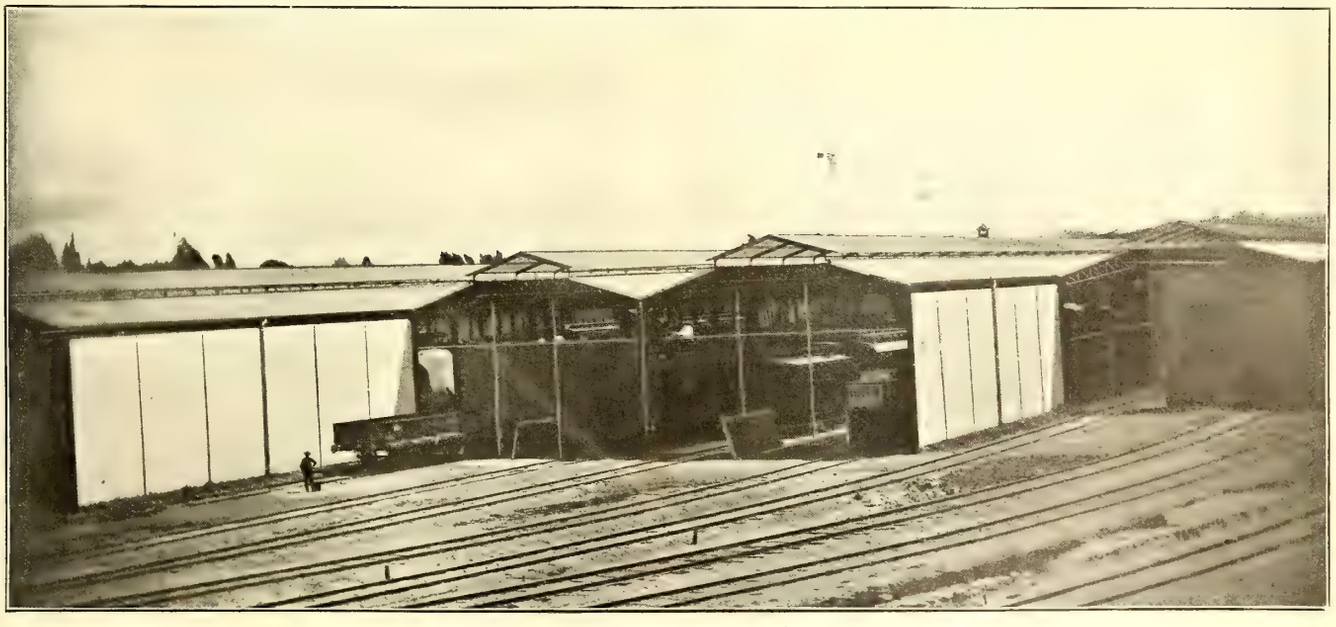
[*From Our Regular Correspondent.*]

Allusion has been made in another article to the startling contrast between the superb Palace of Transportation on the Champ de Mars, and the Transportation Building at the Bois de Vincennes section of the Paris Exposition. In more than one respect the contrast illustrates the promise and the performance, the plan and the realization, of this really great and beautiful World's Fair. The limited space on the Champ de Mars and the Trocadero Hill was given out so lavishly to meretricious, salacious sideshows that there was no room left for the main Exposition or for objects of real value and merit. The money available for a Transportation Building was expended so generously on the one in which very few appropriate exhibits can be found that when it came to provide for the overflow, nothing more could be done than to erect the meagre, cheap sheds which are here shown, and which, as a general thing, can be reached only after the expenditure of considerable time, money and patience. Yet even this division, exasperating as it is, does not quite represent the confusion and muddle, for street railway apparatus is to be found—when found—in no fewer than five different parts of the show, and there are not less than six distinct, different sections in which transportation exhibits, generically considered, have been placed. There may be more, when all the exhibits have finally got into place. If this is borne in mind, with the additional fact that, up to the middle of June, two months after the Exposition opened, no transportation catalogues or lists were obtainable, it will be seen that the mission of the man bent on studying the subject for himself or others is not yet an altogether grateful one.

The Transportation Building at Vincennes is just across a small lawn from the American Machinery Hall, and is best reached by taking the steamboat down the river and the Thomson-Houston street car line up the hill to the main entrance gate, where the line circles. As will be observed,

FRONT OF TRANSPORTATION BUILDING, VINCENNES

the building is in reality a series of low train sheds. Along the white front the names of the different countries are painted, for guidance, and within are a large number of tracks connecting with the steam railroad network of France, so that cars, locomotives and rolling stock of standard gage have been able to come right in and be switched and shunted into position. For pieces not of standard gage special sections of track have been set up. Between the tracks extend long stretches of plank platform up and down which visitors move in inspecting the exhibits. As a general thing, heavy rolling stock has been placed at the inner end of each track and the street cars at the outer or receiving end. Outside the building are other receiving tracks for freight cars, etc. The United States has inside the building about 22,000 square feet, of which 16,000 square feet is net, and and a little over 400 feet of the exterior track.



TRACK ENTRANCE TO TRANSPORTATION BUILDING, VINCENNES

Outside the group of electric locomotives, most of which

are now in position and have had their wrappings taken off, the most interesting and ambitious exhibit is probably that which is intended to illustrate the Budapest underground road. Not only is one of the regular cars shown, but there is a complete cross-section of the road itself, and one of the neat and pretty stations, with the white tiling,

TEMESVAR VASUT TROLLEY CAR

AUSTRO-HUNGARIAN TROLLEY CAR

STEAM LOCOMOTIVE, LYONS-NEUVILLE

stairway, steel columns, platform, etc. The car is also complete in every respect, and carries its bent-bow trolley, while the overhead and track wiring and bonding are also illustrated in detail. If one were to visit Budapest, it would not be possible to see much more. Incidentally, it may be mentioned that elsewhere in the building Austria-Hungary has also two other neat exhibits in the shape of one of the regular street cars in use at Temesvar, showing a very solid vestibule at each end for the motorman; and a fine Prague trolley car.

The French exhibit of street cars and tramway locomotives is quite extensive, but without a very close examina-

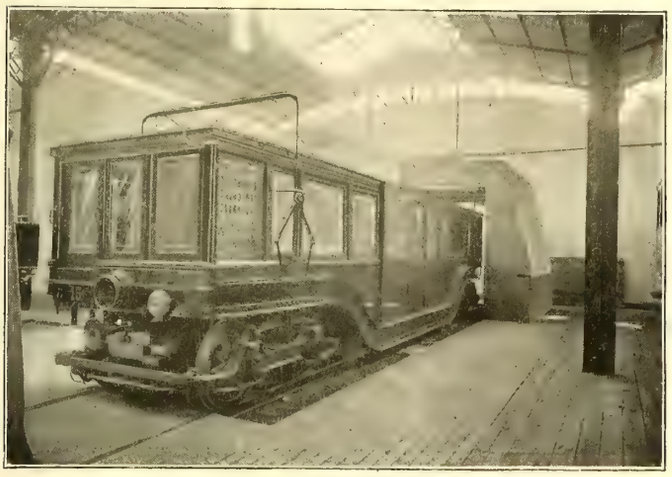
BRILL SNOW SWEEPER

CAR CHEMINS DE FER NOGENTAIS

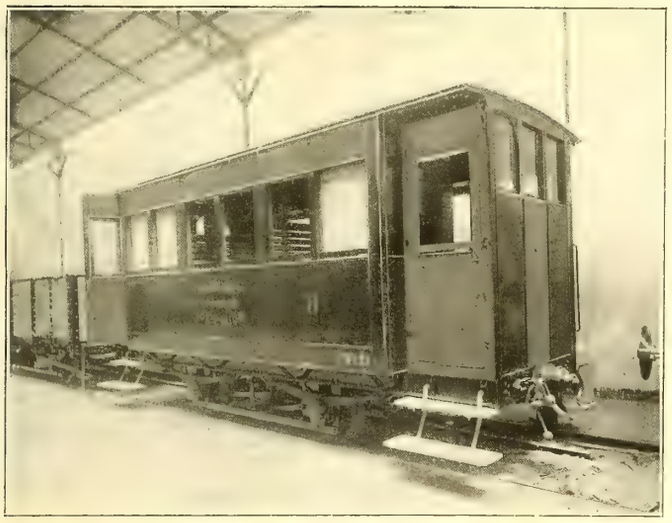
EXACT REPRODUCTION OF BUDAPEST UNDERGROUND ROAD AND STATION

tion it is rather hard to say where the distinctive French part in the exhibit begins and the American part ends. American trucks and cars of such types as the Brill and Peckham are freely used in Europe, and not less freely plagiarized; and on all the newer work the imprint of American ideals and practice is to be detected, in virtually every branch of design and operation. There are, how-

ever, many vehicles unfamiliar to the American visitor, such, for example, as the steam locomotive from Lyons, or the narrow gage, rack rail electric locomotive from the



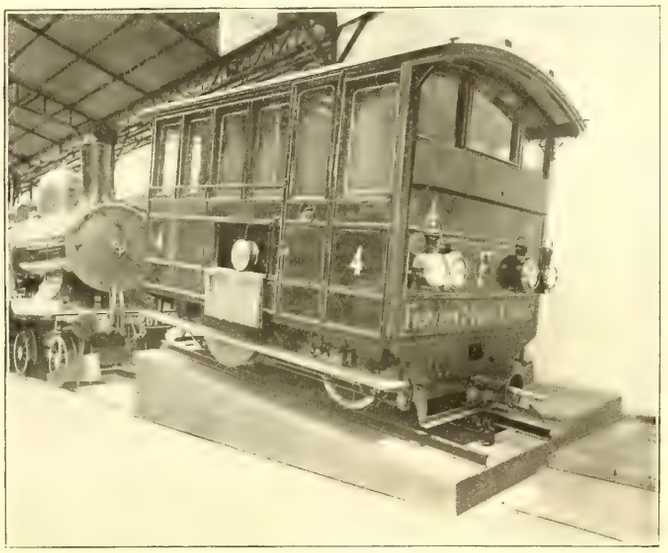
BUDAPEST UNDERGROUND CAR AND ROAD



CAR OF TRAMWAY DEPARTMENT DE L'AUDE

BASTILE-PORT RAPP, DOUBLE-DECKER

Fourviere & Ouest-Lyonnais for very stiff hill climbing. The tramway car of the Department de l'Aude, for second class, is also interesting, if only because of the wonder it engenders at the courage exhibited in trying to operate a tramway line on a steam road basis, with a complicated tariff and all its necessary attendance and bookkeeping. The French exhibit includes also a number of double-deck



ELECTRIC LOCOMOTIVE FOR HILL CLIMBING, FOURVIERE OUEST LYONNAIS

cars of different types, for steam, electricity or compressed air; but these only supplement several shown at the Champ de Mars, as illustrated in the June JOURNAL, or as treated in detail in a separate article on the Vincennes special trolley road.

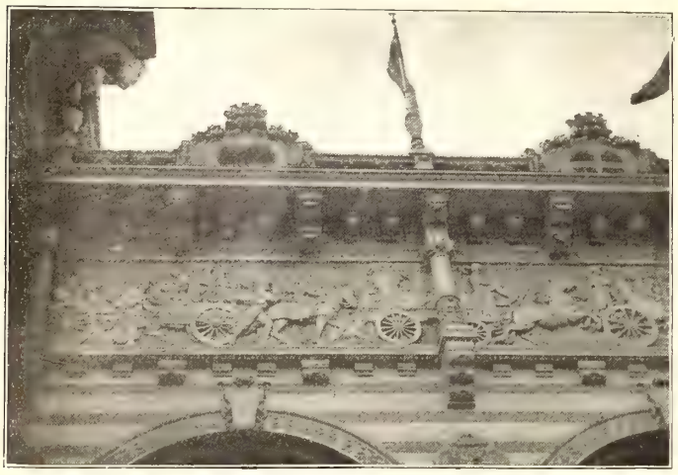
Decorative Panels, Transportation Building, Champ de Mars

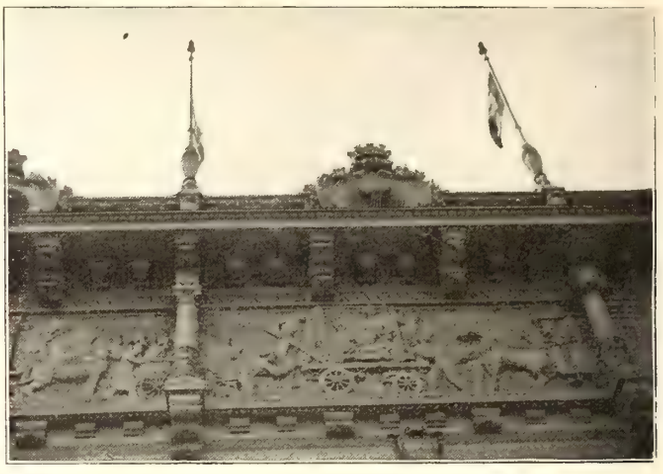
Reference was made in the June issue of the STREET RAILWAY JOURNAL to the series of decorative panels along the facade of the Transportation Building, in the Champ de Mars section of the Paris Exposition. These have at-

FRIEZE AT ENTRANCE TO TRANSPORTATION BUILDING, CHAMP DE MARS

tracted a great deal of attention and admiration, and we are glad now to be able to show a few of the principal groups relating to recent and relatively modern methods of travel

and the transportation of freight. No fewer than twenty of these panels ornament the long front of the building, and as each is about 15 ft. long and 9 ft. high, they attest the industry of their sculptor, Mr. Allar, even if they were not wholly successful from an artistic standpoint or from that of an engineer. But their designer is to be congratulated on the ease and grace with which he has grouped his figures and vehicles and given to all of them flowing lines that not only please the eye, but convey very forcibly the sense of activity and movement. The tableaux reproduced herewith deal more particularly with the achievements of the past century, and in three of them the omnibus, the tramway, the trolley car, the automobile and the bicycle play a very prominent part. As will be noted, the set shown begins with an abundant use of the power of man and beast; but in the finale, the horse has entirely disappeared, and the use of the bicycle is attributed solely to purposes of sport and recreation. Beneath these panels are twenty colossal figures in high relief, ten each side of the main portico, of which a view is here shown also. These "heroic" size figures, one on each pillar face, signed with different names, are intended to represent the motorman, the stage driver, the navvy, the signalman, the train conductor, and others of the leading types of men employed in the construction and operation of street car lines, railroads, bridges, etc.; and, on the whole, a most dignified effect has been happily produced. As a matter of fact, the Transportation Building is the most elaborately treated of all the large palaces on the Champ de Mars, if we except the Chateau d'Eau, which is not a palace, but a mere front to the water supply and condensing system of the power plant. In fact, the contrast between the handsome building devoted to transportation in the main Exposition and the primitive car barns bearing the same designation at Vincennes could not very well be sharper.





DECORATIVE PANELS, TRANSPORTATION BUILDING, SHOWING PROGRESS IN THE SCIENCE OF TRANSPORTATION

DECORATIVE PANELS, TRANSPORTATION BUILDING, SHOWING PROGRESS IN THE SCIENCE OF TRANSPORTATION

DECORATIVE PANELS, TRANSPORTATION BUILDING, SHOWING PROGRESS IN THE SCIENCE OF TRANSPORTATION

Third-Rail in the B. & O. Tunnel

After a long and thorough test of the overhead trolley, the Baltimore & Ohio Railroad Company has decided to install a third-rail system. The heavy combination of Z-bars which formed the overhead conductor will be removed and current for the electric locomotives will be supplied by a rail running outside the wheel rails. This rail is to be of the standard A. S. C. E. section and weigh 75 lbs. per yard. Four miles of double track will be equipped, extending from the northern to the southern side of the city of Baltimore.

According to the proposed plan, in the stations and at some of the crossings where special precautions are desirable the rail is sectionalized electrically. The Murphy safety third-rail system is here used. To minimize the danger of shocks to the workmen and others who may have occasion to use the tracks, the rail is paralleled on each side by a pine plank set on edge. There is a few inches clearance between these guards and the rail, and the top edge of the plank extends a little above the head of the rail.

The insulators consist of blocks of reconstructed granite. These have vertical recesses to receive a pin on a malleable iron casting, which forms the base and extends laterally far enough to support the guard planks. A chair on which the rail rests is leaded on the top of the granite block and completes the insulator.

Transportation Figures at Paris Exposition

The work done by the moving sidewalk and the third-rail road at the Paris Exposition has been very gratifying to the management and to the authorities. It appears that from April 15 to May 13, inclusive, the two systems carried no fewer than 799,479 paying passengers, of whom by far the larger number traveled on the sidewalk, although the trip costs 10 cents while the third-rail fare is but 5 cents. In the period named, one day was lost, April 21, owing to an accident on the transmission cables, and there was a little delay once or twice on the sidewalk due, for example, to the swelling and binding of some of the moving wooden platforms after the heavy rains; but in all other respects both the walk and the road carried their patrons with comfort, regularity and safety.

The greatest number of passengers carried in one day was 75,000, on May 13, when there were slightly over 300,000 people at the show and when the time of operation was ten hours. On Easter Day they carried 61,000 passengers. The travel increases with the growth of the crowds at the Exposition, and it would seem that it is safe to count on handling 25 per cent of all the visitors, for even those who have once ridden for pleasure come back again and again to bring friends and to reach different parts of the grounds quickly. Indeed it is stated by observers that the regular attendants at the Exposition, in care of exhibits, etc., are the best customers, using the services as part of their daily means of transit. We are indebted to M. Maréchal, manager of the two systems, and to Charles Leblanc, general manager of the Compagnie Generale de Traction, which is interested in the enterprises, for the above data. It may be added that the Westinghouse sub-station receiving the current from the transmission line from Issy les Moulineaux, as described already, is in most satisfactory operation, and that the duplicate plants in it have been practically completed. Tests have been made as to the current used, and will be repeated from time to time. The data from the sidewalk would show it to be quite economical of current, with little increase as the load of travel is augmented.

Double-Current Generators for Electric Railway Service

The Massachusetts Electric Companies, which have consolidated thirty-eight railroads and two lighting systems in eastern Massachusetts, propose to reduce the cost of operation of their extensive system by centralizing their generating stations. The first move in this direction will be on that part of their system in and around Salem, and will be made by the addition of polyphase apparatus to transmit power from the present Salem direct-current station to neighboring towns. Sub-stations will be located in Wakefield, Essex and Gloucester.

Two 800-kw double-current generators will be installed at Salem, direct coupled to engines, making probably the first case of direct-coupled double-current machines for railway service in this country. These machines may be run in parallel with the three 300-kw direct-current machines now in service at this point, although there is some doubt as to the advisability of so running them on account of the disturbing effects of wattless currents on the field strength of the double-current machines. Since this disturbing effect will not be felt on the direct-current machines, it may affect the division of the direct-current load between the two classes of machines. If this is so to a serious extent, it may be necessary to run the double-current machines on a separate set of busses and a separate load from the direct-current machines.

The Massachusetts Electric Companies own the Lowell & Suburban road with its pioneer polyphase transmission line from Lowell to Nashua. The new transmission will be carried out in the same manner to a large extent.

Street Car Building

(Stephenson Practice.)

BY CHARLES HENRY DAVIS, C. E.

VI.—Assembling—(Continued)

In the June issue of the STREET RAILWAY JOURNAL we gave the details of the bottoms for our two standard cars; namely, the Boston (closed) and the Brooklyn (open). Tables Nos. 33 and 34 give respectively the details of bodies for these standard cars, while Plates V. and VI. illustrate the various parts. As in Tables 31 and 32, each distinct part of the body is described, giving the material, the general dimensions, how made, on what tools and how assembled, all in consecutive order as each car is built in the shop. In using these tables they are to be read across the page line by line as in the case of any book. In column 1 the numerals indicate, in consecutive order, the number of distinctive pieces; where a letter follows the numeral it indicates another operation, but not another distinctive piece. Letters in column 4 are the same abbreviations of timbers as used on Plates I. and II. These tables are given on the following seven pages.

The Toledo Traction Company has just issued a time table for the running of its cars, in the form of a little folder, which contains also some particulars of the city, as well as a handsomely lithographed bird's eye view of Toledo, in which the routes of the company's system are shown. In this map the site of the Ohio Centennial and Northwestern Territory Exposition in 1902 is clearly shown.

TABLE NO. 33

DETAIL OF SIDES AND ENDS (BODY) OF BOSTON CLOSED CAR, IN THE ORDER OF ASSEMBLING

(25 ft. Body; Car No. 2; Fig. 3; Plates I. and V.)

Consecutive Number	Quantity	Name of Piece	Piece Number Plates I. and V.	Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate V.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
33	8	**Side-posts** (Figs. 80, 81)	1002	A.	--	----------	--	5 ft. 11⅛ in. x 5 in. x 1⅝ in.	Are now (*see Table No. 31 and Plate II.*) laid on one side of the car flooring opposite their respective positions; each one is previously prepared as follows:—	
					1	Gain	a	3½ x 1¼ in. x ¾ in.	For side belt-rail (1015), Figs. 94, 95	Car gainer
					1	Gain	b	3 in. x 2 in.	For side rib-rail (1017), Figs. 99, 100	Car gainer
					1	Tenon	c	1⅝ in. x 1¼ in.	To tenon into mortise of side-sill, with hole for dowel-pin	Car gainer
					1	Tenon	d	1½ in. x 1 in.	To tenon into mortise of side top-rail (1005), Fig. 93	Car gainer
					2	Rabbets	e		For the window-sash to slide in, leaving a bead (g) on the outside, called the outside window-stop (1034). There are also	Routing machine
34	16	**Post parting-strips** (Fig. 90)	1035	C.	--	----------	--	2 ft. 10 in. x 1¼ x ⅝ x ¼ in.	Shown at (f) Figs. 80, 81, screwed to side-posts; they are temporarily attached merely to indicate their position, and when the sashes are fitted later they are secured with 64 No. 7 x ⅞ in. bronze screws	
35	16	**Sash parting-strips** (Not Ill.)	1037		--	----------	--	2 ft. 3 in. x ¼ in. x ¼ in.	Nailed to the posts along the rabbet (f) from below the belt-rail to the floor, to guide the sash when it is lowered; they are clearly seen in Fig. 75	
36	1	**Side belt-rail** (Figs. 94, 95)	1015	A.	--	----------	--	24 ft. 7¾ in. x 4 in. x 1¾ in.	Is now fitted to above side-posts, the gains (a) of the posts interlocking with the	
					8	Gains	a	1⅝ in. wide	Of the belt-rail; and, being further secured by small wooden wedges, are also screwed through	Multiple gainer
					16	Holes	b		With 8 No. 14 x 2 in. and 8 No. 14 x 3 in. steel screws to side-posts	Borer or multiple spindle drill
					1	Rabbet	c	1¾ in. x ½ in.	Runs the whole length of the belt-rail to receive the convex-panel	Molding machine
					1	Rabbet	d	½ in. x 1 in.	The whole length of the rail, for the window-sashes to rest on	Molding machine
					2	Tenons	--	3½ in. x 2½ in.	To fit into mortises (a) in corner-posts (1001), Figs. 76 to 79	End tenoner
					27	Mortises	--	1½ in. x ⅝ in. x 5-16 in.	On under side of rail for convex-panel ribs (1021), Fig. 86, to tenon into. For securing belt-rails to corner-posts, *see Con. No. 56 c*	Hollow chisel mortiser
37	2	**Side-post strap-bolts** (Fig. 124)	1501	W. I.	--	----------	--	9⅜ in. x ½ in.	Are now screwed to side-posts with 16 lag screws 1⅝ in. x ¼ in., after which the side-posts are erected upon one of the side-sills, the tenons being well white-leaded before being driven into their respective mortises, the strap-bolts well tightened up and the side-posts draw-pinned	
	6	**Side-post strap-bolts** (Fig. 125)	1501	W. I.	--	----------	--	9 9-16 x ½ in.		
37a	8	**Side-posts**	1002	A.	--	----------	--		The other side consisting as above of:—	
37b	16	**Post parting-strips**	1035	C.	--	----------	--			
37c	16	**Sash parting-strips**	1037		--	----------	--			
37d	1	**Side belt-rail**	1015	A.	--	----------	--			
37e	8	**Side-post strap-bolts**	1501	W. I.	--	----------	--		Is now put together and similarly erected, after which:—	
38	2	**Side rib-rails** (Figs. 99, 100)	1017	A.	--	----------	--	24 ft. 7¾ in. x 3½ x 2⅜ in.	Are screwed to the side posts, and secured with 16 No. 14 x 2 in. and 16 No. 14 x 3 in. steel screws. Each one has:—	
					8	Gains	a	1⅝ in. x 3-16 in.	To interlock with corresponding gains (b) of the side-posts	Multiple gainer
					2	Gains	a_1	2¾ in. x 3-16 in.	To interlock with corresponding rabbets (b) of the corner-posts (1001)	End tenoner
					27	Gains	b	1½ in. x 2½ in. x ⅜ in.	To receive the concave-panel ribs (1022), Fig. 87	Multiple gainer
					1	Rabbet	c	1 in. x ½ in.	To receive the convex-panel (1027)	Molding machine
					27	Rabbets	d	1½ in. x ⅝ in. x ½ in.	To receive the convex-panel ribs (1021), Fig. 86	Hollow chisel mortiser
					36	Holes	e		For screws to secure side fender-rail (1019), Fig. 101, to side rib-rail	Borer or multiple spindle drill
					4	Holes	f		For screws to secure the side rib-rail to corner posts	Borer or multiple spindle drill
					16	Holes	g		For screws to secure the side rib-rail to side posts as above	Borer or multiple spindle drill
					1	Rabbet	h	2¼ in. x ⅜ in.	To receive the concave-panel (1028), Fig. 113	Molding machine
									For securing side rib-rails to corner-posts. (*See Con. No. 56 d*)	
39	42	**Convex-panel ribs** (Fig. 86)	1021	A.	--	----------	--	17¼ in. x 1½ in. x ¾ in.	Each one having:—	Shaper
					1	Tenon	a	1½ in. x ½ in. x 5-16 in.	To fit into mortises on under side of side belt-rail	Double end tenoner and gainer
					1	Tenon	b	1½ in. x ⅝ in. x ½ in.	To fit into rabbets (d) of side rib-rail, to which they are screwed with 42 No. 12 x 1 in. steel screws. There are altogether 54 side panel-ribs, but the three next to each corner-post are put in later. (*See Con. No. 57 a*)	Double end tenoner and gainer
40	42	**Concave-panel ribs** (Fig. 87)	1022	A.	--	----------	--	10 in. x 1½ in. x ¾ in.	Each with:—	Shaper
					1	Tenon	a	1½ in. x ⅜ in.	To fit in mortises (d) of side-sills (Fig. 32, Plate IV.)	End tenoner
					1	Hole	b		For No. 14 x 2 in. screws to secure the ribs to the rib-rails. There are also 54 of these ribs, but the three next each corner-post are put in later. (*See Con. No. 57 b*)	Borer
41	4	**Convex-panel cleats** (Not Ill.)	1024	A.	--	----------	--	16 in. x 1½ in. x 1 in.	Glued and screwed with 16 No. 12 x 1¾ in. screws to the sixth side-post on opposite ends of the body (2 on each post) for securing the convex-panel splices	Shaper and borer
42	4	**Concave-panel cleats** (Fig. 88)	1025	A.	--	----------	--	10 in. x ¾ in. x 1 in.	Glued and screwed with 16 No. 12 x 1¾ in. screws to the sixth side-post on opposite ends of the body (2 on each post) for securing the concave-panel splices.	Shaper and borer
43	2	**Corner-posts** (Figs. 77, 78)	1001a	A.	--	----------	--	6 ft. 1⅞ in. x 8⅞ x 5 x 4 in.	And	
43a	2	**Corner-posts** (Figs. 76, 79)	1001b	A.	--	----------	--	6 ft. 1⅞ in. x 8⅞ x 5 x 4 in.	Are now set in the side-sill mortises (j), Fig. 33, Plate IV., but not fastened until later. (*See Con. No. 56 b*). Each one is previously prepared as follows:—	
					1	Mortise	a	3½ in. x 2½ in.	To receive tenon of side belt-rail (1015)	Hollow chisel mortiser
					1	Rabbet	b	3 in. x 2 in.	To interlock with gain (a_1) of side rib-rail (1017), Figs. 99, 100	Car gainer
					1	Tenon	c	3½ in. x 1¼ in.	To fit into mortise (j) of the side-sill	Double end tenoner and gainer

					1	Gain	d	2½ in. x 1 in.	To receive the end of the side top-rail (1005), Fig. 93	Double end tenoner and gainer
					1	Gain	e	4¼ in. x ½ in.	To receive the end of the letter-board (1010), Figs. 96, 97	Double end tenoner and gainer
					1	Rabbet	f	5-16 in. deep	For the window-sash to slide in	Routing machine
					1	Mortise	g	3¾ in. x 1¼ in. x ½ in.	To receive the tenon of the end belt-rail (1016), Fig. 120	Hollow chisel mortiser
					1	Mortise	h	2½ in. x 1¼ in. x ½ in.	To receive the tenon of the end rib-rail (1018), Fig. 121	Hollow chisel mortiser
					1	Rabbet	i	3¼ in. x ⅜ in.	To receive upper end-panel (1029)	Planer
					1	Mortise	j	1¾ in. x 9-16 in. x 1¼ in.	To receive nut of corner-post joint-bolt (1503), Fig. 128	Hollow chisel mortiser
					1	Mortise	k	2 in. x ⅜ in.	To receive tenon of end-lining top-rail (4023)	Hollow chisel mortiser
					2	Mortises	l	2¼ in. x ⅜ in.	To receive tenons of end-lining middle-rail (4024)	Hollow chisel mortiser
					1	Groove	m		To bury the trolley wire in	Routing machine
					1	Rabbet	n	4¼ in. x 2½ in. x ½ in.	To receive end window-lintel (1012), Fig. 118	Hollow chisel mortiser
					1	Rabbet	o	5-16 in. deep	From the top of the post to the belt-rail, to receive the end sash	Planer
					1	Mortise	p	1 in. x ⅜ in.	For sliding-door rear-track (4509)	Hollow chisel mortiser
					1	Gain	r	3⅜ in. x 1 in.	To receive the end of the end top-rail (1006), Figs. 108 to 111	End tenoner
					1	Rabbet	s	2 in. x ½ in.	To receive convex-panel (1027)	Shaper
									There are also :—	
44	4	**Post parting-strips** (Fig. 91)	1035	C.	--	----------	--		Shown at (t) Fig. 78, and	
45	2	**Inside window-stops** (Fig. 92)	1033	C.	--	----------	--		Shown at (u) Fig. 78, which are temporarily attached merely to indicate their position. With the bead along the outer edge of the post, called the outside window-stop (1034), they make two grooves, in one of which the window-sash slides, and in the other the window-shade. When the sashes are fitted later, they are secured with 26 No. 7 x ⅞ in. bronze screws	
46	2	**Door-posts (thick) on left hand** * (Figs. 82, 83)	1003	A.	--	----------	--	7 ft. 0⅞ in. x 3⅛ in. x 2½ in.	Are now set in the end-sill mortises (i), Fig. 36, Plate IV., but not fastened until later. (*See Con. No. 56 a*). Each one has been previously prepared as follows :—	
					1	Tenon	a	2½ in. x ½ in.	To fit into mortise of the end-sill, with two holes for dowel-pins	Double end tenoner and gainer
					1	Tenon	b	2½ in. x ½ in.	To fit into mortise of the end top-rail (1006), Fig. 108, with two holes for dowel-pins	Double end tenoner and gainer
					1	Mortise	c	3¼ in. x ½ in.	To receive tenon of end belt-rail (1016), Fig. 120	Hollow chisel mortiser
					1	Mortise	d	2½ in. x ½ in.	To receive tenon of end rib-rail (1018), Fig. 121	Hollow chisel mortiser
					1	Rabbet	e		To receive end of door-lintel (1011), Fig. 119	Hollow chisel mortiser
					1	Mortise	f		To receive tenon of door-lintel (1011), Fig. 119	Hollow chisel mortiser
					1	Rabbet	g	4¼ in. x ½ in.	To receive end window-lintel (1012), Fig. 118	Hollow chisel mortiser
					1	Rabbet	h	5-16 in. deep	For the stationary end window-sash to fit in	Planer
					1	Rabbet	i	⅜ in. deep	To receive the upper and lower end-panels (1029, 1030)	Planer
					1	Mortise	j	1 in. x ⅜ in.	For the end of the sliding-door top-rack (4508) to fit in	Hollow chisel mortiser
47	2	**Door-posts (thin) on right hand** (Figs. 84, 85)	1004	A.	--	----------	--	7 ft. 0⅞ in. x 2½ in. x 1¾ in.	Are now set in the end-sill mortises (j), Fig. 36, Plate IV., but not fastened until later. (*See Con. No. 56 a*). Each one has been previously prepared as follows :—	
					1	Tenon	a	2½ in. x ½ in.	To fit into mortise of the end-sill, with two holes for dowel pins	Double end tenoner and gainer
					1	Tenon	b	2½ in. x ½ in.	To fit into mortise of the end top-rail (1006), Fig 108, with two holes for dowel-pins	Double end tenoner and gainer
					1	Mortise	c	3¼ in. x ½ in.	To receive tenon of end belt-rail (1016), Fig. 120	Hollow chisel mortiser
					1	Mortise	d	2½ in. x ½ in.	To receive tenon of end rib-rail (1018), Fig. 121	Hollow chisel mortiser
					1	Rabbet	--		Not shown, to receive end of door-lintel, corresponding to (e) Fig. 83	Hollow chisel mortiser
					1	Mortise	--		Not shown, to receive tenon of door-lintel, corresponding to (f) Fig. 83	Hollow chisel mortiser
					1	Rabbet	e	4¼ in. x ½ in.	To receive end window-lintel (1012), Fig. 118	Hollow chisel mortiser
					1	Rabbet	f	5-16 in. deep	For the stationary end window-sash to fit in	Planer
					1	Rabbet	g	⅜ in. deep	To receive the upper and lower end-panels (1029, 1030)	Planer
					1	Rabbet	i	1 in. x ⅜ in.	For the end of the sliding-door rear-track (4509) to fit in	Hollow chisel mortiser
					1	Rabbet	j	1 in. x ⅜ in.	For the end of the sliding-door rear-sheave guide (4515) to fit in	Hollow chisel mortiser
					1	Pocket	k		To clear sliding-door rear-sheave (4513)	Borer
									There are also :—	
48	2	**Inside window-stops** (Fig. 89)	1033	C.	--	----------	--		Also shown at (h) Fig. 84, which are temporarily attached to show their position. When the sashes are later fitted, the window-stops are finally secured with 8 No. 7 x ⅞ in. bronze screws	
49	4	**End belt-rails** (Fig. 120)	1016	A.	--	----------	--	2 ft. 1⅝ in. x 3⅞ in. x 1¾ in.	Each having :—	
					1	Tenon	a	3¼ in. x 1¼ in.	Tenoned into corner-post mortise (g), Fig. 79	Double end tenoner and gainer
					1	Tenon	b	3¼ in. x 1¼ in.	Tenoned into door-post mortise (c), Figs. 82, 85	Double end tenoner and gainer
					1	Rabbet	c	⅜ in. deep	To receive the upper end-panel (1029)	Planer
					1	Rabbet	d	1 in. x ½ in.	For the window-sash to rest on when closed	Planer
					3	Rabbets	e	2 in. x 1½ in. x ½ in.	To interlock with the body end-ribs (1023), Fig. 131 ; these rails are firmly secured and pinned later, when the whole body framework is thoroughly squared. (*See Con. No. 55 a*)	Hollow chisel mortiser
50	4	**End rib-rails** (Fig. 121)	1018	A.	--	----------	--	2 ft. 1⅛ in. x 2 in. x 1¼ in.	Each having :—	
					1	Tenon	a	2½ in. x 1¼ in.	Tenoned into corner-post mortise (h), Fig. 79	Double end tenoner and gainer
					1	Tenon	b	2½ in. x 1¼ in.	Tenoned into door-post mortise (d), Figs. 82, 85	Double end tenoner and gainer
					3	Gains	c	2 in. x ½ in.	To interlock with the body end-ribs (1023), Fig. 131 ; these rails are pinned later. (*See Con. No. 55 b*)	Double end tenoner and gainer
51	2	**Door-lintels** (Fig. 119)	1011	A.	--	----------	--	2 ft. 5 in. x 5¾ in. x 1¾ in.	Each having :—	
					1	Tenon	a		Tenoned into door-post mortises (f), Fig. 83, and gained with door-post rabbet (e), Fig. 83	Double end tenoner and gainer
					1	Tenon	b		Tenoned into door-post mortises, and gained with door-post rabbets of thin door-posts, Figs. 84, 85, not shown, but corresponding to those of Figs. 82, 83. These are each pinned to the door-posts with four hickory dowel-pins	Double end tenoner and gainer
52	4	**End window-lintels** (Fig. 118)	1012	A.	--	----------	--	2 ft. 5 in. x 4¼ in. x ½ in.	Fitted to corner-post rabbets (n), Fig. 79, thick door-post rabbets (g), Fig. 83, and thin door-post rabbets (e), Fig. 84, to all of which they are screwed with 20 No. 12 x 1¼ in. steel screws	
53	2	**End top-rails** (Figs. 108 to 111)	1006	A.	--	----------	--	7 ft. 2 in. x 5½ in. x 1⅛ in.	In two pieces, spliced, and screwed together with 16 No. 14 x 1½ in. steel screws ; each one has :—	
					2	Gains	a	3⅜ in. x ¾ in.	Interlocked with corner-post gain (r), Figs. 77, 79, and secured with 12 No. 14 x 3 in. steel screws	Double end tenoner and gainer
					2	Gains	b		To receive the ventilator plain-bottom-rail (2002)	Car gainer
					2	Rabbets	c	2 in. x 1¼ in. x ⅝ in.	For ventilator end-corner-post (2004) shown in Fig. 107	Hollow chisel mortiser
					2	Mortises	d	2½ in. x ½ in.	To receive tenons (b) of door-posts, Figs. 82 to 85, which are draw-pinned	Hollow chisel mortiser

*In speaking of "right hand" and "left hand," the reader is supposed to be in the center of the car, and in this case looking toward the door. It will then be seen that, contrary to usual custom, the door, when being opened, slides to the right.

TABLE NO. 33—*Continued*

Consecutive Number	Quantity	Name of Piece	Piece Number Plates I. and V.	Material See Plates I and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate V.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
					4	Holes	e	⅝ in. diam.	For trolley wires to pass through	Borer or multiple spindle drill
					1	Rabbet	f	¼ in. x ⅝ in.	For ventilator end-sash (4007) to rest on	Shaper
									There are also screwed to the end top-rails :—	
54	14	**Furring-pieces** (Fig. 114 to 116)	1038	A.			-		Of various shapes and sizes, also seen in place in Fig. 111, secured with 32 No. 14 x 1½ in. to 3½ in. steel screws. These are to fasten the inside door-head lining to	
55	2	**Side top-rails** (Fig. 93)	1005	V. P.				25 ft. 0 in. x 3½ in. x 3¼ in.	Are now adjusted to the side-posts, the tenons of the latter entering the mortises on the underside of the rails. They are secured later. (*See Con. No. 58 a*). Each rail has :—	
					27	Gains	a	1⅛ in. x 1¼ in.	For the lower deck rafters to fit in	Double end tenoner and gainer
					1	Rabbet	b	⅝ in. x ½ in.	To receive the letter board (1010), Figs. 96, 97	Molding machine
					8	Gains (not marked in ill.)	c	⅛ in. x 1¼ in.	For the lower deck compound carlins to fit in	
									The body framework is now squared, after which several of the previous operations are completed, as follows :—	
55a	--	**End belt-rails**	1016	----	--	...	--		Are secured to corner and door-posts with 8 hickory dowel-pins (*See Con. No. 49*)	
55b	--	**End rib-rails**	1018	----	--	...	--		Are secured to corner and door-posts with 12 hickory dowel-pins. (*See Con. No. 50*)	
56	4	**Door-post strap-bolts** (Fig. 126)	1504	W. I.	--	...	-	12⅝ in. x ⅝ in.	Fastened to door-posts with 8 lag screws 1⅝ in. x ½ in., after which the four	
56a	--	**Door-posts**	1003,4	----	--	...	--		(*Con. Nos. 46, 47*) are bolted to end-sills with above strap-bolts, and pinned with 8 hickory dowel-pins	
56b	--	**Corner-posts**	1001a,b	----	--	...	--		(*Con. Nos. 43, 45*) are now pinned to side-sills with 8 hickory dowel-pins. (*See Con. No. 80* for completion)	
56c	--	**Side belt-rails**	1015	----	--	...	--		(*Con. No. 39*) are now secured to corner-posts with 4 No. 14 x 3 in. and 4 No. 14 x 2 in. steel screws	
56d	--	**Side rib-rails**	1017	----	--	...	--		(*Con. No. 38*) are now secured to corner-posts with 4 No. 14 x 3 in. and 4 No. 14 x 2 in. steel screws. Work then proceeds as follows :—	
57	8	**Body end-ribs** (Fig. 131)	1023	A.	-	...	--	2 ft. 10¼ in. x 1½ in. x ⅞ in.	And	
	4	**Body end-ribs** (Fig. 131)	1023	A.	--	...	-	2 ft. 6⅛ in. x 1½ in. x ⅞ in.	Each having :—	
					1	Gain	a	2 in. x ⅜ in.	To fit into rabbets (e) of end belt-rails (1016), Fig. 120	Car gainer
					1	Gain	b	2 in. x ⅜ in.	To interlock with gain (c) of end rib-rails (1018), Fig. 121	Car gainer
					1	Gain	c	1½ in. x ⅜ in.	To interlock with rabbet (h) of end sills (2), Fig. 36. The gain (c) of the four shorter ribs interlocks with rabbet (n) of side-sills (1), Fig. 33. The ribs are secured with 36 No. 12 x 1 in. steel screws	Car gainer
57a	12	**Convex-panel ribs** (Fig. 86)	1021	A.	--	...	--	17¼ in. x 1½ in. x ¾ in.	Fitted same as the 42 ribs, *Con. No. 39*, these being the three next to each corner-post, and secured with 12 No. 12 x 1 in. steel screws	
57b	12	**Concave-panel ribs** (Fig. 87)	1022	A.	--	...	--	10 in. x 1½ in. x ¾ in.	Fitted same as the 42 ribs, *Con. No. 40*, these being the three next to each corner-post, and secured with 12 No. 14 x 2 in. steel screws	
58	4	**Side-braces** (Fig. 129)	1026	A.	--	...	--	2 ft. 11¼ in. x 2½ x 1¾ in.	Each with :—	
					3	Gains	a	1½ in. x ¾ in.	For convex-panel ribs; screwed to corner-posts with 4 No. 20 x 5 in. screws to side rib-rails with 4 No. 20 x 4 in. screws, and to convex-panel ribs with 12 No. 12 x 1¼ in. steel screws	Car gainer
58a	--	**Side top-rails**	1005	----	--	...	--		(*Con. No. 55*) are now pinned to side-posts, and fitted and screwed to corner-posts with 8 No. 14 x 3 in. steel screws	
59	2	**Concave-panels** (Fig. 113)	1028	P.	--	...	--	25 ft. 0 in. x 17⅜ in. x ⅜ in.	The body at this stage is accurately represented by Fig. 75 In two pieces, spliced, the splicing being made at the side-posts with the panel-cleats (1025) (*See Con No 42*). The panels, after being bent on a former and dried, are glued, white-leaded, and nailed to the corner and side-posts, the rib-rails, side-sills and panel-ribs	
60	72	**Side-sill watersheds** (Not Ill.)	1052	P.	--	...	--	6⅝ in. x ¾ in. x ¾ in.	Glued to panels and side-sills between all the panel-ribs	
61	--	**Linen scrim**	----	----	--	...	--		Is now glued to the concave panels, lapping on to ribs, posts, rails and side-sills	
62	2	**Convex-panels** (Fig. 107)	1027	P.	--	...	--	24 ft. 8 in. x 18½ in. x 1½ in.	In two pieces, spliced same as the concave-panels. They are also glued, white leaded and nailed to the corner and side-posts, the belt and rib-rails and the panel-ribs. They are also screwed to corner and side-posts with 100 No. 10 x 1¼ in. steel screws	
63	72	**Rib-rail watersheds** (Not Ill.)	1051	P.	--	...	--	6⅝ in. x 11-16 in. x 11-16 in.	Glued to panels and rib-rails between all the panel-ribs	
64	--	**Linen scrim**	----	----	--	...	--		Is now glued to the convex-panels, lapping onto ribs, posts and rails	
65	4	**Lower end-panels** (Fig. 107)	1030	P.	--	...	--	1 ft. 9 in. x 2 ft. 4½ in. x ⅜ in.	Glued, white-leaded and nailed to the corner and door-posts, the end rib-rails, end-sills and end-ribs	
66	4	**Upper end-panels** (Fig. 107)	1029	P.	--	...	--	2 ft. 2 in. x 1 ft. 7 in. x ⅜ in.	Glued, white-leaded and nailed to the corner and door-posts, the end belt and rib-rails, and the panel ribs. They are also screwed to the corner-posts with 20 No. 10 x 1¼ in. screws	
67	--	**Linen scrim**	----	----	--	...	--		Is now glued to the end-panels, lapping onto posts, rails, end-sills and ribs	
68	8	**Furring-pieces** (Fig. 117)	1038	A.	--	...	--		Of various shapes and sizes, as shown, screwed to end top-rail (1006) with 20 No. 14 steel screws; they are used in connection with the wiring	
69	2	**Furring-pieces** (Fig. 138)	1038	A.	--	...	--		For sliding-door top-track (4508), screwed to end top-rail	
70	2	**Furring-pieces** (Fig. 139)	1038	A.	--	...	--		For sliding door rear-track (4509), screwed to end top-valance (1013)	
71	2	**End top-valances** (Fig. 112)	1013	P.	--	...	--	⅜ in. thick	Glued and nailed to end top-rail, side and door-posts and end window-lintels	
72	2	**Letter-boards** (Figs. 96, 97)	1010	A.	--	...	--	25 ft. 0¾ in. x 7 in. x 1 in.	Screwed through	
					90	Holes	a		To side top-rails with No. 12 x 1½ in. steel screws, and through	Borer or multiple spindle drill

					60	Holes	b		To corner and side-posts with No. 12 x 1½ in. steel screws. There are also in each one :	Borer or multiple spindle drill
					45	Holes	c		For screws to secure the drip-rails (1014). *See Con. No. 75*	Borer or multiple spindle drill
73	2	**Side fender-rails** (Fig. 101)	1019	A.	..	----------	..	25 ft. 2½ in. x 3 in. x 1⅞ in.	Screwed to side rib-rails through holes (e), Figs. 99, 100, with 72 No. 14 x 3 in. steel screws	
74	4	**End fender-rails** (Fig. 122)	1020	A.	..	----------	..	2 ft. 6½ in. x 1¼ in. x 1¼ in.	Screwed to end rib-rails (Fig. 121) with 24 No. 14 x 1½ in. to 2½ in. steel screws	
75	2	**Drip-rails** (Fig. 98)	1014	A.	..	----------	..	24 ft. 9 in. x 1¾ in. x ⅞ in.	Screwed through (c) Fig. 97 to letter-boards with 90 No. 12 x 2 in. steel screws	
76	4	**Corner-post angle-plates** (Fig. 127)	1511	W. I.	..	----------	..		Screwed to corner posts and top end-rails with 16 No. 16 x 2½ in. steel screws	
77	2	**Belt-rail bands** (Not Ill.)	1505	W. I.	..	----------	..	⅞ in half-round	Screwed to side and end belt-rails with 152 No. 12 x 1½ in. steel screws	
78	2	**Fender-guards** (Not Ill.)	1506	W. I.	..	----------	..	⅞ in. half-round	Screwed to side and end fender-rails with 152 No. 12 x 1½ in. steel screws	
79	20	**Convex-panel iron-straps** (Fig. 141)	1507	W. I.	..	----------	..	1¼ in. x 3-32 in.	Screwed through convex-panels at each corner and side-post, between belt and fender-rails, with 160 No. 10 x 1¼ in. steel screws ; these and the following straps are all leaded before putting on	
80	20	**Concave-panel iron-straps** (Fig. 142)	1508	W. I.	..	----------	..	1¼ in. x 3-32 in.	Screwed through the concave-panels at each corner and side-post, from fender-rail to bottom of the panel, with 160 No. 10 x 1¼ in. steel screws	
81	4	**Upper end-panel iron-straps** (Fig. 143)	1509	W. I.	..	----------	.	1 in. x 3-32 in.	Screwed to corner posts over the edges of the upper end panels with 32 No. 10 x 1¼ in. steel screws	
82	4	**Lower end-panel iron-straps** (Fig. 144)	1510	W. I.	..	----------	..	1¼ in. x 3-32 in.	Screwed to door-posts over the edges of the lower end-panels with 36 No. 10 x 1¼ in. steel screws	
83	8	**Corner-post ½ round-moldings** (Not Ill.)	1031	P.	..	----------	..	1½ in. wide	Nailed to sides and ends of corner-posts, from belt-rail to end top-valance	
84	4	**Door-post ½ round-moldings** (Not Ill.)	1032	P.	..	----------	..	1½ in. wide	Nailed to door-posts from end top-valance to fender-rail	
85	4	**Platform step-hanger brackets** (Fig. 123)	1512	C. I.	..	----------	..		Screwed to corner posts, side and end-sills with 44 No. 18 x 1¾ in. steel screws. They are also further secured by 4 bolts in holes (a), 6¼ in. x ½ in., countersunk heads, which pass through the end-sills and overhang truss-rod anchor-irons. (*See Con. No. 24, Table 31*)	
86	4	**Corner-post joint-bolts** (Fig. 128)	1503	W. I.	..	----------	..	17 in. x ½ in.	Are now inserted through a hole in underside of platform step-hanger bracket, through end sill hole (c), Fig. 36, Plate IV., through side-sill hole (k), Figs. 32, 33, Plate IV., and into the corner-post, being then secured by the nut inserted in the hole (j) in the corner-post (Fig. 79). This completes *Con. No. 50 b*	
87	36	**Sash-rests** (Not Ill.)	1053	A.	..	----------	..	6 in. x ¾ in. x ¾ in.	Nailed to the bottom of the side-sills for the window-sashes to rest on when lowered	
88	2	**Overhang truss rod queen-posts** (Fig. 32, Plate IV.)	516	C. I.	..	----------	..	7 in. x 7¼ in. x 1¾ in.	Screwed to side-sills and secured with 8 lag screws, 2½ in. x ½ in. (*See Con. No. 24, Table 31*)	
89	2	**Truss-rods** (Not Ill.)	515	W. I.	..	----------	..	1 in. diam.	In two pieces, joined together with :—	
90	2	**Overhang truss-rod turn-buckles** (Fig. 32, Plate IV.)	518	M. I.	..	----------	..	9 in. x 2¼ in. x 2 in.	The ends of the rods being passed through the anchor-irons (517) (*see Con. No. 24, Table 31*) and secured with nuts, are then passed over the queen posts and joined together with the turn-buckles, which are screwed up tight	
91	4	**Seat-rail cleats** (Fig. 132)	1056	A.	..	----------	..	23¾ in. x 1¼ in. x ⅞ in.	Screwed to corner posts with 20 No. 10 x 2½ in. steel screws ; a shoulder at the bottom serves to support the back seat-supporting-rail (1054), Fig. 102	
92	2	**Back seat-supporting-rails** (Fig. 102)	1054	A.	..	----------	..	24 ft. 5¾" x 3¼" x 1½" & ⅝"	Screwed to side-posts and seat-rail cleats with 20 No. 14 x 1½ in. and 20 No. 14 x 2½ in. screws. Each rail has :—	
					1	Shoulder	a	1¾ in. x ⅞ in.	Its whole length to support the seat-lids (1060), Fig. 136	Molding machine
					8	Rabbets	b	1½ in. x ⅞ in. x ½ in.	To receive the seat-bearing cross-bars (1059), Fig. 137	Hollow chisel mortiser
93	2	**Lock-rails** (Fig. 103)	1055	A.	..	----------	..	24 ft. 5¾ in. x 4¼ in. x ⅞ in.	Each having :—	
					8	Gains	a	4¼ in. x 1⅝ in. x ¾ in.	To fit side-posts and seat-rail cleats to which they are screwed with 40 No. 14 x 1½ in. steel screws	Car gainer
94	16	**Seat-legs** (Fig. 134)	1058	A.	..	----------	..	13⅞ in. x 1½ in. x ¾ in.	Each having :—	
					2	Round tenons	..		To fit into corresponding holes in the floor and the seat-bearing cross-bars (1059). They are now glued and driven into the holes in the flooring-boards, after which :—	End tenoner and lathe
95	16	**Seat-bearing cross-bars** (Fig. 137)	1059	A.	..	----------	..	15½ in. x 1½ in. x 1½ & ⅝ in.	Each having :—	
					1	Tenon	a	⅞ in. x ½ in.	Are fit into rabbets (a) of the back seat-supporting-rails (1054), and are then screwed to them with 32 No. 10 x 1½ in. screws	End tenoner
					1	Tenon	b	¾ in. x ½ in.	To fit into similar rabbets of the front seat supporting-rail (1057), Fig. 104	End tenoner
					1	Hole	c	¾ in. diam.	(Not seen), into which the top tenon of the seat-leg is driven, being well glued first	Horizontal borer
96	2	**Front seat-supporting-rails** (Figs. 104, 105)	1057	A.	..	----------	..	24 ft. 3⅞ in. x 2 in. x 1⅛ in.	Each having :—	
					8	Rabbets	a	1½ in. x ¾ in. x ½ in.	To receive the tenons (b) of the seat-bearing cross-bars (1059), to which they are screwed with 32 No. 10 x 1½ in. screws	Hollow chisel mortiser
					1	Rabbet	b	¾ in. x ½ in.	Running its whole length, to receive the seat-lids (1060), Fig. 136	Molding machine
					1	Bead	c	½ in. x ⅛ in.	Running its whole length, to secure the front seat-supporting-rail facia (4121)	Molding machine
97	18	**Seat-lids** (Fig. 136)	1060	A. & P.	..	----------	..	2 ft. 8¼ in. x 15 in. x ⅞ in.	Being composed of :—	
97a	54	**Seat-lid boards** (Not Ill.)	1062	P.	..	----------	..	10¾ in. x 15 in. x ⅞ in.	Joined together and screwed to	
98	36	**Seat-lid battens** (Not Ill.)	1061	A.	..	----------	..	2 ft. 6¾ in. x 2½ in. x ½ in.	With 216 No. 10 x ¾ in. steel screws	
99	4	**Mud-blocks** (Fig. 135)	1067	Y. P.	..	----------	..	6½ in. x 2½ in. x ½ in.	Screwed to the floor near the door-posts	
100	4	**Door stop-blocks** (Fig. 140)	1049	A.	..	----------	..		Screwed to corner-posts with 4 No. 14 x 2 in. screws	
101	2	**Plain advertising-rack rails** (Fig. 106)	1069	A.	..	----------	..	24 ft. 4 in. x 4¾ in. x ⅞ in.	Screwed through	
					32	Holes	a		To side-posts with No. 14 x 2 in. steel screws, and	Borer or multiple spindle drill
					54	Holes	b		To side top-rails with No. 14 x 2 in. steel screws. Each one has also	Borer or multiple spindle drill
					45	Holes	c		Through which the screws (c) (*Con. Nos. 72, 75*), can be got at without taking down the whole rail	Borer or multiple spindle drill
					1	Rabbet	d	½ in. x ⅛ in.	Running its whole length, for the lower-deck ceiling-panel (4075)	Molding machine
					1	Rabbet	e	½ in. x ¼ in.	Running its whole length, for wires to the electric-bell push-buttons (4538)	Molding machine
102	2	**Door-sill plates** (Fig. 146)	1513	C. I.	..	----------	..		Screwed to end-sills between door-posts, and secured with 22 No. 14 x 1 in. screws	
103	2	**Door guide-plates** (Fig. 145)	1514	C. I.	..	----------	..		Screwed to end-sills between corner-posts and thin door-posts (1004), and secured with 6 No. 14 x 1 in. steel screws	
									The body is now ready to receive the roof, for description of which see *Con. No. 104, Table No. 35 and Plate VII.*	

Number of Distinctive Pieces	71	(Column 1)
Total Number of Pieces	746	(" 2)
Number of Bolts	4	(" 6 and 10)
Number of Screws (about)	2150	(" 6 and 10)
Number of Nails	?	
Total	2900	

Note.—Pieces described under Con. Nos. 91 to 100 are not usually assembled at this stage, but as they cannot be classified with "Cabinet Work," they are brought in here. Reference will be made to them further on when describing other pieces or operations to which they are accessory.

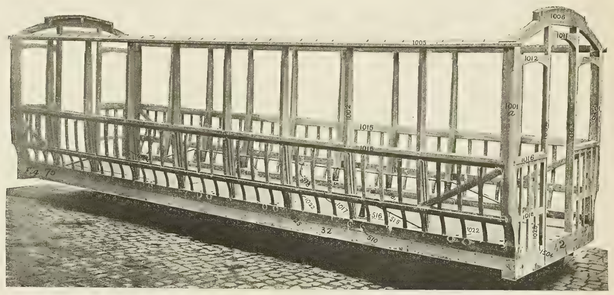
TABLE NO. 34

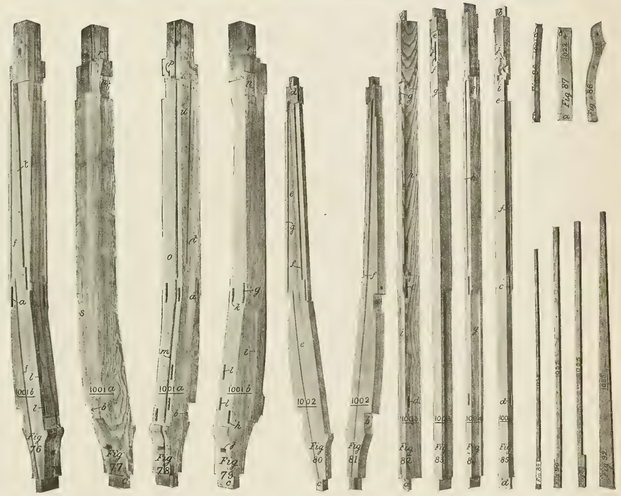
DETAIL OF SIDES AND ENDS (BODY) OF BROOKLYN OPEN CAR, IN THE ORDER OF ASSEMBLING

(12 benches; Car No. 4; Fig. 5; Plates II. and VI.)

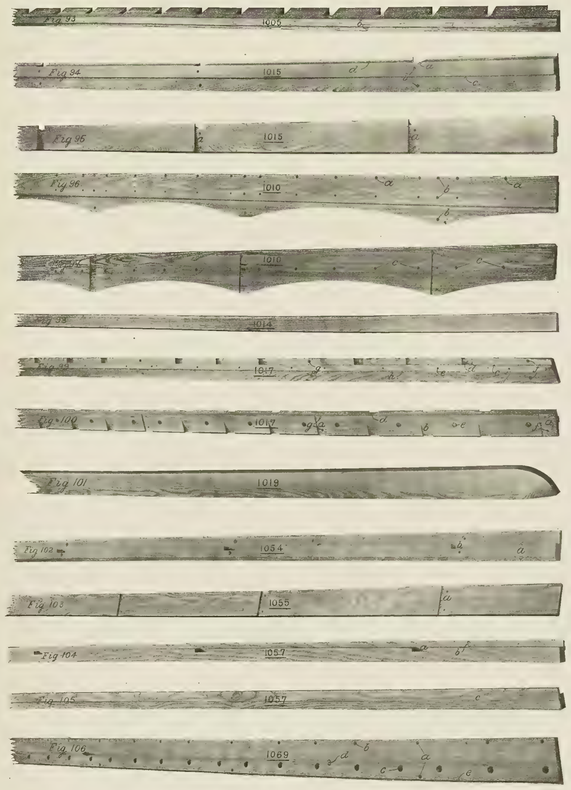
Consecutive Number	Quantity	Name of Piece	Piece Number Plates II. and VI.	Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate VI.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									The assembling of the pieces composing the ends of an open car is proceeded with independently of the bottom (*see Table No. 32 and Plate II.*), and only when the end framework or end-bulkhead (6001) as it is termed, is completed, as shown in Fig. 147, is the building up of the car body as a whole proceeded with. The pieces of which the end-bulkheads are composed, and the manner in which they are assembled, are as follows, all joints being well glued:—	
28	4	**End center-posts** (Figs. 170, 171)	6005	A.			..	6 ft. 11⅝ in. x 3⅝ x 1¾ in.	Each having:—	
					1	Tenon	a	2¼ in. x 1⅛ in. x ⅞ in.	To tenon into mortise (b) of bottom false-sill (6011), Fig. 161	Double end tenoner and gainer
					1	Gain	b	5¼ in. x 1⅛ in. x ½ in.	For outside end-bottom-rail (6010), Fig. 160, to gain into	Double end tenoner and gainer
					1	Gain	c	5¼ in. x 1½ in. x ½ in.	For inside end-bottom-rail (6009), Fig. 159, to gain into	Double end tenoner and gainer
					1	Gain	d	2⅝ in. x 1½ in. x 13-16 in.	For outside end-belt-rail (6008), Fig. 158, to gain into	Double end tenoner and gainer
					1	Gain	e	2 13-16 in. x 1½ in. x ½ in.	For inside end-belt-rail (6007), Fig. 157, to gain into	Double end tenoner and gainer
					1	Gain	f	3½ in. x 1½ in. x ½ in.	For end sub-top-rail (6012), Fig. 162, to gain into	Double end tenoner and gainer
					1	Tenon	g	2⅜ in. x 1½ in. x ½ in.	To tenon into mortise (b) on underside of end top-rail (6006), Fig. 150	Double end tenoner and gainer
					2	Bolt-holes	h	⅜ in. diam.	For bolts to secure the end-post strap-bolts (6509), Fig. 191	Borer or multiple spindle drill
					2	Rabbets	i	5-16 in. deep	Running down the post from the gain (f) to the bottom, for the window-sashes to slide in, leaving beads (j) on the outside, called the outside window-stop. To complete the grooves in which the 6 end-sashes slide, there are in all:—	Planer
29	12	**Post parting-strips** (Fig. 175)	6024	A.			..	2 ft. 9 15-16 x ⅞ & ¾ x 5-16 in.	Also shown at (k), Fig. 171, screwed to the different end-posts with 60 No. 7 x ¾ in. bronze screws	
30	4	**False end-posts** (Figs. 172, 173)	6004	A.			..	6 ft. 5⅞ in. x 3⅝ in. x 1⅜ in.	Each having:—	
					1	Tenon	a	2 in. x 1⅛ in. x ⅞ in.	To tenon into mortise (d) of bottom false-sill (6011), Fig. 161	Double end tenoner and gainer
					1	Gain	b	5¼ in. x 1⅛ in. x ½ in.	For outside end-bottom-rail (6010), Fig. 160, to gain into	Double end tenoner and gainer
					1	Gain	c	5¼ in. x 1⅛ in. x ½ in.	For inside end-bottom-rail (6009), Fig. 159, to gain into	Double end tenoner and gainer
					1	Gain	d	2⅝ in. x 1⅛ in. x 13-16 in.	For outside end-belt-rail (6008), Fig. 158, to gain into	Double end tenoner and gainer
					1	Gain	e	2 13-16 in. x 1⅛ in. x ½ in.	For inside end-belt-rail (6007), Fig. 157, to gain into	Double end tenoner and gainer
					1	Gain	f	3½ in. x 1⅛ in. x ½ in.	For end sub-top rail (6012), Fig. 162, to gain into	Double end tenoner and gainer
					1	Tenon	g	2⅜ in. x 1⅛ in. x ½ in.	To tenon into mortise (c) on under side of end-top-rail (6006), Fig. 150	Double end tenoner and gainer
					1	Rabbet	h	5-16 in. deep	Running down the post from the gain (f) to the bottom, for the window-sash to slide in, leaving a bead (i) on the outside, called the outside window-stop. Post parting-strips (6024), Fig. 175, also shown at (j) are screwed to the posts to complete the grooves in which the end-sashes slide. (*See Con. No. 29*)	Planer
					1	Rabbet	..	2 ft. 8¾ in. x 1⅛ in. x 5-16 in.	Running from gain (f) to gain (d) on the other side of the post, for the bulkhead-panel (9043) to fit in	Planer
31	2	**End top-rails** (Figs. 150, 151, 152)	6006	A.			..	6 ft. 11¾ in. x 4⅛ in. x 1¾ in.	In two pieces, spliced, glued and screwed together with 16 No. 14 x 1½ in. steel screws, each one having:—	
					2	Tenon	a	3½ in. x 2⅜ in. x ⅞ in.	To fit into mortises (b) of corner-posts (6002), Figs. 148, 149	Double end tenoner
					2	Mortises	b	2⅜ in. x 1½ in. x ½ in.	On underside, to receive tenons (g) of end center-posts (6005) with ¼ in. holes for wood pins	Hollow chisel mortiser
					2	Mortises	c	2⅜ in. x 1⅛ in. x ½ in.	On underside, to receive tenons (g) of false end-posts (6004) with ¼ in. holes for wood pins	Hollow chisel mortiser
					1	Mortise	d	1½ in. x 2 in. x ½ in.	On upperside, to receive tenon of ventilator end-center-post (7006) with ¼ in. hole for wood pin	Hollow chisel mortiser
					2	Mortises	e	2 in. x 1⅞ in. x ½ in.	On upperside, to receive tenons of ventilator end-corner-posts (7004) with ¼ in. holes for wood pins	Hollow chisel mortiser
					2	Rabbets	f	2 3-16 in. x 1 in. x 3-16 in.	For end top-rail tie-plates (6504), Fig. 176	Hollow chisel mortiser
					2	Rabbets	g	1 ft. 8½ in. x ½ in. x 5-16 in	To receive the ventilator end-sign-sashes (9017)	Shaper
32	2	**Bottom false-sills** (Fig. 161)	6011	A.			..	6 ft. 2¼ in. x 3⅝ in. x 1¼ in.	Each having:—	
					2	Tenons	a	¾ in. x ¾ in. x 1¼ in.	To tenon into mortises (g) of the corner-posts (6002), Figs. 148, 149	Double end tenoner
					2	Mortises	b	1½ in. x ⅞ in. x 1¼ in.	To receive tenons (a) of end center-posts (6005) with ¼ in. holes for wood pins	Holllow chisel mortiser
					2	Bolt-holes	c	½ in. diam.	For end center-post strap-bolts (6509), Fig. 191	Borer or multiple spindle drill
					2	Mortises	d	1⅛ in. x ⅞ in. x 1¼ in.	To receive tenons (a) of false end-posts (6004)	Hollow chisel mortiser
									The tenons of the end-posts are inserted in their respective mortises in the end top-rail and bottom false-sill, and after being squared the end center-posts are draw-pinned	
33	2	**Inside end-belt-rails** (Fig. 157)	6007	A.			..	6 ft. 10½ in. x 2⅞ in. x ¾ in.	Each having:—	
					2	Tenons	a	1¾ in. x ⅜ in. x 2⅞ in.	One at each end (not seen in the figure) to fit into mortises (e) in corner-posts (6002)	Double end tenoner and gainer
					2	Gains	b	1½ in. x ¼ in. x 2⅞ in.	To interlock with gains (e) of the end center-posts (6005) to which they are screwed with 8 No. 12 x 1¼ in. bronze screws.	Double end tenoner and gainer
					2	Gains	c	1⅛ in. x ¼ in. x 2⅞ in.	To interlock with gains (e) of the false end-posts (6004) to which they are screwed with 8 No. 12 x ¼ in. bronze screws.	Double end tenoner and gainer
34	2	**Inside end-bottom-rails** (Fig. 159)	6009	A.			..	6 ft. 7⅜ in. x 5¼ in. x ¾ in.	Same as outside end-bottom-rails, Fig. 160, each having:—	
					2	Tenons	a	1¾ in. x ⅜ in. x 5¼ in.	One at each end, to fit into mortises (c) in corner-posts (6002)	Double end tenoner and gainer
					2	Gains	b	1½ in. x ¼ in. x 5¼ in.	To interlock with gains (c) of the end center-posts, to which they are screwed with 8 No. 12 x 1¼ in. bronze screws	Double end tenoner and gainer
					2	Gains	c	1⅛ in. x ¼ in. x 5¼ in.	To interlock with gains (c) of the false end-posts, to which they are screwed with 8 No. 12 x 1¼ in. bronze screws	Double end tenoner and gainer
35	2	**Outside end-belt-rails** (Fig. 158)	6008	A.			..	6 ft. 10½ in. x 2⅞ in. x 1⅛ in.	Each having:—	
					2	Tenons	a	1¾ in. x ½ in. x 2⅝ in.	To fit into mortises (d) in corner-posts (6002)	Double end tenoner and gainer
					2	Gains	b	⅞ in. x ¼ in. x 2⅝ in.	To interlock with gains (d) of the end center-posts, to which they are screwed with 8 No. 12 x 1¼ in bronze screws	Double end tenoner and gainer
					2	Gains	c	13-16 in. x ¼ in. x 2⅝ in.	To interlock with gains (a) of the false end-posts, to which they are screwed with 8 No. 12 x 1¼ in. bronze screws	Double end tenoner and gainer
					1	Rabbet	d	⅞ in. x ¼ in.	Full length for the window-sashes to rest on	Molding machine

BOSTON CLOSED CAR. (Table No. 33.)

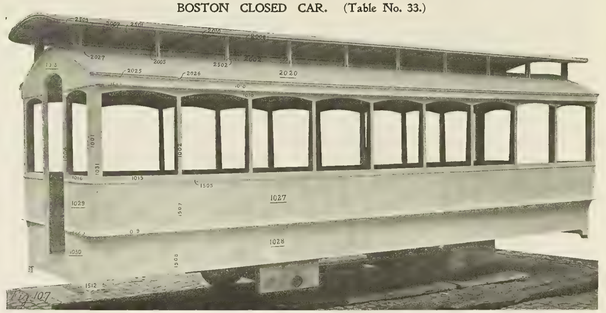


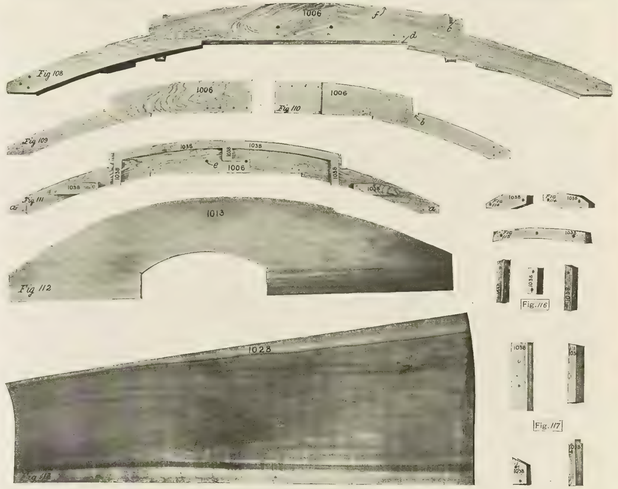


BOSTON CLOSED CAR. (Table No. 33.)



BOSTON CLOSED CAR. (Table No. 33.)





BOSTON CLOSED CAR. (Table No. 33.)

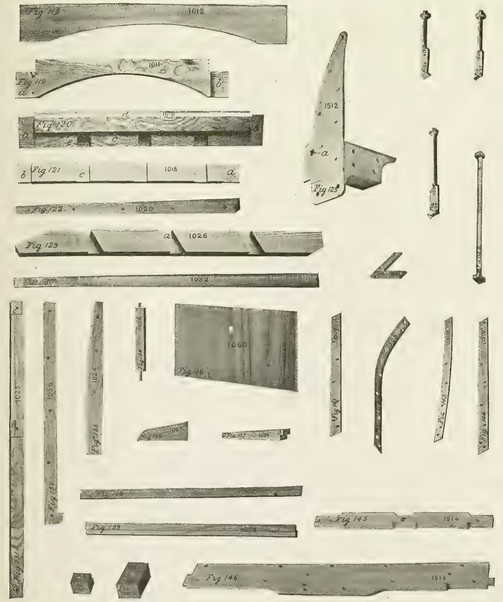


PLATE V. [Figs. 75 to 146]

DETAILS OF SIDES AND ENDS (BODY) OF

BOSTON CLOSED STANDARD CAR

ILLUSTRATING

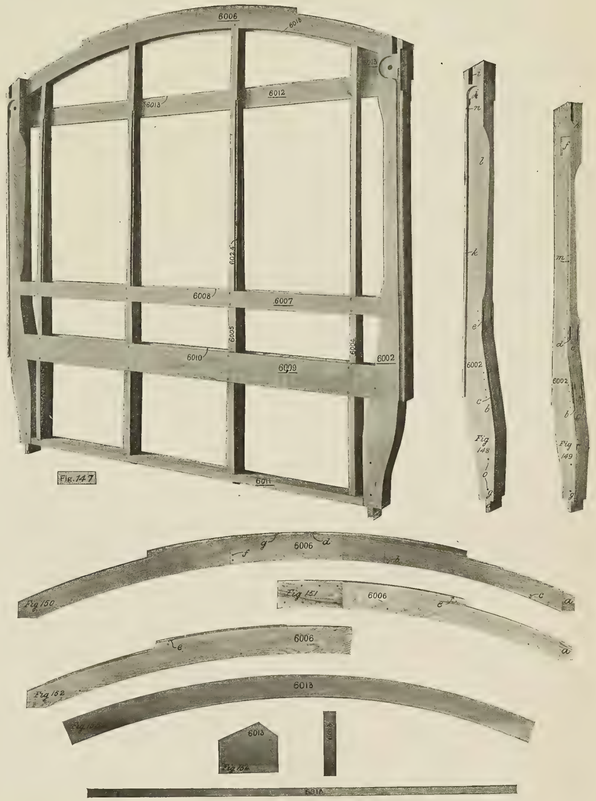
STREET CAR BUILDING

(Stephenson Practice)

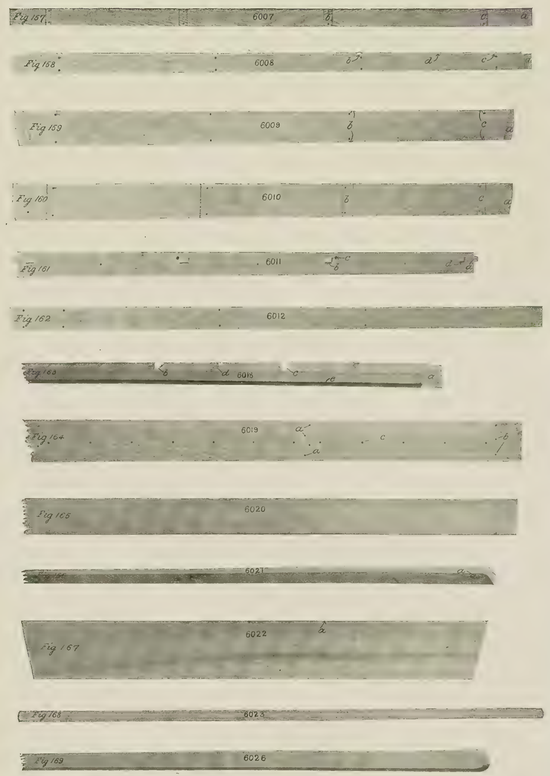
By

Charles Henry Davis, C. E.

BROOKLYN OPEN CAR. (Table No. 34.)



BROOKLYN OPEN CAR. (Table No. 34.)



BROOKLYN OPEN CAR. (Table No. 34.)

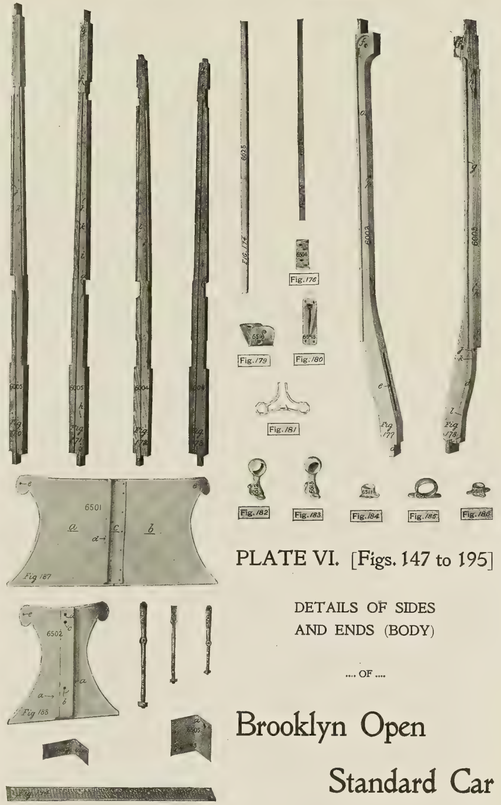


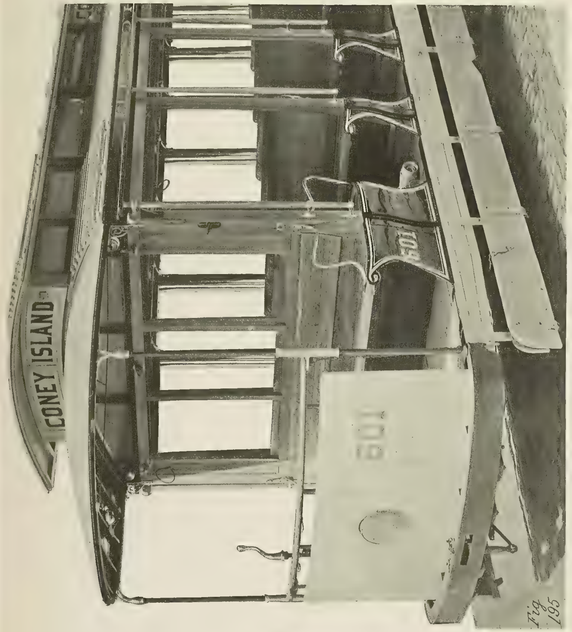
PLATE VI. [Figs. 147 to 195]

DETAILS OF SIDES AND ENDS (BODY)

.... OF ....

Brooklyn Open Standard Car

BROOKLYN OPEN CAR. (Table No. 34.)



ILLUSTRATING

STREET CAR BUILDING

(Stephenson Practice)

By

Charles Henry Davis, C. E.

36	2	**Outside end-bottom-rails** (Fig. 160)	6010	A.	--	----------	--	6 ft. 7⅜ in. x 5¼ in. x ¾ in.	Same as inside end-bottom-rails, Fig. 159, each having :—
					2	Tenons	a	1¾ in. x ⅜ in. x 5¼ in.	To fit into mortises (b) in corner-posts (6002) — Double end tenoner and gainer
					2	Gains	b	1½ in. x ¼ in. x 5¼ in.	To interlock with gains (b) of the end center-posts, to which they are screwed with 8 No. 12 x ¼ in. bronze screws — Double end tenoner and gainer
					2	Gains	c	1⅛ in. x ¼ in. x 5¼ in.	To interlock with gains (b) of the false end-posts, to which they are screwed with 8 No. 12 x 1¼ in. bronze screws — Double end tenoner and gainer
37	2	**End sub-top-rails** (Fig. 162)	6012	A.	--	----------	--	6 ft. 11½ in. x 3½ in. x ½ in.	Each one fitting in gains (f) of the end center-posts, and the gains (f) of the false end-posts, to which they are screwed with 16 No. 12 x 1¼ in. steel screws. They further fit in rabbets (f) of the corner-posts, to which they are also screwed with 8 No. 12 x 1¼ in. steel screws
									The inside portion of the end-bulkhead framework being put together as described, and thoroughly squared, it is completed by the addition of
38	4	**Corner-posts** (Figs. 148, 149)	6002	A.	--	----------	--	6 ft. 5 in. x 4 in. x 3⅝ in.	Each having :—
					1	Tenon	a	2¼ in. x ⅞ in. x 3⅝ in.	To fit into mortise (a) of the side-sill, Plate IV., Fig. 49 — End tenoner
					1	Mortise	b	5¼ in. x 1¾ in. x ⅜ in.	For tenon (a) of the outside end bottom-rail (6010) to fit into — Hollow chisel mortiser
					1	Mortise	c	5¼ in. x 1¾ in. x ⅜ in.	For tenon (a) of the inside end-bottom-rail (6009) to fit into — Hollow chisel mortiser
					1	Mortise	d	2⅝ in. x 1¾ in. x ½ in.	For tenon (a) of the outside end-belt-rail (6008) to fit into — Hollow chisel mortiser
					1	Mortise	e	2⅞ in. x 1¾ in. x ¾ in.	For tenon (a) of the inside end-belt-rail (6007) to fit into — Hollow chisel mortiser
					1	Rabbet	f	3½ in. x 2 in. x ½ in.	For ends of end sub-top-rail (6012) to fit in — Hollow chisel mortiser
					1	Mortise	g	1¼ in. x ¾ in. x ¾ in.	For tenon (a) of the bottom false-sill (6011) to fit into — Hollow chisel mortiser
					1	Mortise	h	3½ in. x 2⅜ in. x ⅞ in.	For tenon (a) of the end top rail (6006) to fit into — Hollow chisel mortiser
					1	Mortise	i	2⅝ in. x 2 in. x ⅞ in.	For tenon (a) of the side top-rail (6018), Fig. 163, to fit into — Hollow chisel mortiser
					1	Pocket	j	3½ in. diam.	For curtain edge to fit in when rolled up ; there is a counterbore 13-16 in. diam. in the center to receive the end of the curtain-roller and the roller-sockets. — Borer
					1	Groove	k	½ in. x ½ in.	For the curtain-guides to slide in — Routing machine
					1	Chamfer	l		To take away the sharp edge of the post — Shaper
					1	Rabbet	m	2 ft. 8¾ in. x ½ in. x 5-16 in.	For the bulkhead-panel (9043) to fit in — Planer
					1	Rabbet	n	6⅝ in. x 1⅞ in. x. ⅜ in.	For side sub-top-rail (6019) to fit in — Hollow chisel mortiser
					2	Bolt-holes	o	⅜ in. diam.	For bolts to secure corner-post strap-bolts (6507) — Borer or multiple spindle drill
					1	Pocket	--		(Not seen) at the top on the outside face of the post, similar to pocket (n) of the side-post, seen in Fig. 181, for guard-rail catch-finger (6515), Fig. 178, to fit in
									The tenons of the various end-rails are well glued, then inserted in their corresponding mortises in the corner-posts, and afterward draw-pinned with hickory dowel-pins. To further strengthen the bulkhead
39	4	**End top-rail tie-plates** (Fig. 176)	6504	S. I.	--	----------	--	4⅜ in. x 1 in. x 3-16 in.	Are inserted in rabbets (f) of the end top rail, and screwed to it and to the end center-posts with 16 No. 12 x 1 in. steel screws.
40	2	**End-valance arch pieces** (Fig. 153)	6013	P.	--	----------	--	5 ft. 9 in. x 3½ in. x ⅜ in.	Are now nailed to the end top-rails, end sub-top-rails, corner and end-posts ; how they are placed may be judged from the full view of the bulkhead as it now appears, Fig. 147, where the valance pieces make a kind of bead 5-16 in. wide round the three upper end openings of the bulkhead, to secure the glass for the bulkhead valance lights
	4	**End-valance corner pieces** (Fig. 154)	6013	P.	--	----------	--	9 ft. x 9⅞ in. x ⅜ in.	
	4	**End-valance upright pieces** (Fig. 155)	6013	P.	--	----------	--	11⅛ in. x 2⅛ in. x ⅜ in.	
	2	**End-valance bottom pieces** (Fig. 156)	6013	P.	--	----------	--	5 ft. 7¼ in. x 1½ in. x ⅜ in.	
									The end-bulkheads are now erected bodily on the car bottom, the corner-post tenons being driven into the side-sill mortises (a) Plate IV., Fig. 49, after being well white-leaded. The two bottom false-sills (6011) are then screwed to the flooring-boards with 6 No. 14 x 2 in steel screws, while further stability is secured by
41	4	**Corner-post strap-bolts** (Fig. 189)	6507	W. I.	--	----------	--	15⅝ in. x 9-16 in.	Bolted to the corner-posts through holes (o), Fig. 148, with 8 bolts 4¼ in. x 5-16 in., and inserted in holes (h) in the side-sills, Fig. 49, and tightened up with their nuts
42	4	**End-post strap-bolts** (Fig. 191)	6509	W. I.	--	----------	--	10½ in. x 9-16 in.	Bolted to the end center-posts, through holes (h), Fig 171, with 8 bolts 2⅛ in. x 5-16 in., and inserted in holes (c) of the bottom false-sills (Fig. 161) and the flooring-boards, and tightened up with their nuts
									The assembling of the pieces composing the body now proceeds as follows :—
43	16	**Side-posts** (Figs. 177, 178)	6003	A.	--	----------	--	6 ft. 5 in. x 2¾ in. x 2 in.	Each having :—
					1	Tenon	a	2¼ in. x ⅞ in. x 2¾ in.	To fit into mortises (b) in side-sills, Plate IV., Fig. 49 — Double end tenoner and gainer
					1	Tenon	b	2½ in. x ⅝ in. x 2¾ in.	To fit into mortises on underside of side top-rail (6018), Fig. 163, not seen in the figure — Double end tenoner and gainer
					1	Gain	c	6 in. x ⅜ in.	For side sub-top-rail (6019) to fit in — Double end tenoner and gainer
					2	Rabbets	d	½ in. x ½ in. x 1 ft. 6⅛ in.	To fit side-post seat-end iron-panel (6502), Fig. 188 — Shaper
					1	Mortise	e	10¼ in. x 1 in. x ¾ in.	For seat division-board to fit in — Hollow chisel mortiser
					2	Pockets	f	3½ in diam.	For curtain edges to fit in when rolled up ; there is a counterbore 13-16 in. diam. in the center to receive the ends of the curtain-roller and the roller-sockets — Borer
					2	Grooves	g	½ in. x ½ in.	For the curtain-guides to slide in — Routing machine
					1	Bolt-hole	h	7-16 in. diam.	For reversible seat-back arm-pivot (9505) to hold pillar-handle middle-socket (6512) and reversible seat-back arm (9503) — Borer or multiple spindle drill
					1	Bolt-hole	i	⅜ in. diam.	For bolt to hold pillar-handle bottom-socket (6513) — Borer or multiple spindle drill
					1	Bolt-hole	j	7-16 in. diam.	For bolt to secure side-post seat-end iron-panel (6502) to side-post — Borer or multiple spindle drill
					1	Bolt-hole	k	½ in. diam.	For side-post tie-rod (6510) — Borer or multiple spindle drill
					1	Bolt-hole	l	7-16 in. diam.	For bolt to secure side-post seat-end iron-panel (6502) to side-post — Borer or multiple spindle drill
					1	Bolt-hole	m	⅜ in. diam.	For bolt to secure side-post strap-bolt (6508) to side-post, with counterbore ½ in. deep for the bolt head. — Borer or multiple spindle drill
					1	Pocket	n		For guard-rail catch finger (6515) to fit in, it is only in the third side-post from each end, making 4 in all — Borer and hollow chisel mortiser
					2	Grooves	o	⅛ in. x ⅛ in. x 20 in.	For wires to electric push-button (8616) — Circular saw
					1	Pocket	p	⅝ in. diam. x 7-16 in. deep	For electric push-button (8616) — Borer
									The mortises (n) in the side-sills, Fig. 49, being white-leaded, the side-posts are driven in and secured with
44	16	**Side-post strap-bolts** (Fig. 190)	6508	W. I.	--	----------	--	11 3-16 in. x 7-16 in.	Bolted and screwed to side-posts through holes (m), Fig. 181, with 16 bolts 3¼ in. x 5-16 in. and 16 No. 10 x 1¼ in. steel screws ; they are inserted in holes (i) of the side sills, Plate IV., Fig. 49, and tightened up with their nuts
45	2	**Side top-rails** (Fig. 163)	6018	Y. P.	--	----------	--	26 ft. 0 in. x 3 in. x 2¼ in.	Each having :—
					2	Tenons	a	2⅝ in. x 2 in. x ⅞ in.	To fit in mortises (i) of the corner-posts (6002) — Double end tenoner and gainer
					8	Mortises	--	2½ in. x ⅝ in. x 2¾ in.	To receive tenons (n) of the side-posts (6003); they are on the underside of the rail and not seen in the figure
					8	Gains	b	1⅞ in. x ⅞ in.	For lower-deck compound-carlines (7010) — Double end tenoner and gainer
					2	Gains	c	1¾ in. x ⅞ in.	For lower-deck thick-rafters (7011); these are next the corner-posts — Double end tenoner and gainer
					18	Gains	d	13-16 in. x ⅞ in.	For lower-deck thin-rafters (7012) — Double end tenoner and gainer
					1	Rabbet	e	⅝ in. x ⅜ in.	Running the whole length for side sub-top-rail (6019) to fit in — Molding machine
									These rails are adjusted to the corner and side-posts, and secured with 4 No. 16 x 3 in. steel screws to the former, and with hickory dowel-pins to the latter
46	2	**Side sub-top-rails** (Fig. 164)	6019	A.	--	----------	--	25 ft. 11⅜ in. x 6⅝ in. x ⅜ in	Screwed to side-posts through holes (a) with 64 No. 12 x 1 in. steel screws, and to corner posts through holes (b) with 12 No. 12 x 1 in. steel screws
47	2	**Side top-panels** (Fig. 165)	6020	P.	--	----------	--	26 ft. 4 in. x 5 11-16 in. x ⅜ in.	Nailed to side sub-top-rail (6019)
48	2	**Drip-rails** (Fig. 166)	6021	A.	--	----------	--	26 ft. 3¼ in. x 8½ in. x 1½ in.	Each having :—
					10	Pockets	a	1¼ in. diam.	For pillar-handle top-sockets to fit in ; the drip-rails are secured to the side sub top-rails (6019) by 98 No. 12 x 12 in. steel screws, screwed through holes (c) in the latter and through the side top-panels into the drip-rail — Borer
49	8	**Seat division-boards** (Fig. 167)	6022	P.	--	----------	--	6 ft. 8½ in. x 10½ in. x 1 in.	Adjusted to side-posts, and fitted in the mortises (e) of the side-posts (6003)

TABLE NO. 34—*Continued*

Consecutive Number	Quantity	Name of Piece	Piece Number Plates II. and VI.	Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate VI.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
					1	Groove	a	½ in. x ½ in.	Runs along the top edge for the side-post tie rod to lie in	Molding machine
50	8	**Foot-rail brackets** (Fig. 181)	6503	C. I.	..	.....	..		Bolted to the bottom of the seat division-boards, in their centre (6022), with 8 bolts 2¼ in. x ⅜ in., to hold the foot-rails	
51	16	**Foot-rails** (Fig. 168)	6023	A.	..	.....	..	6 ft. 7¾" x 1¼" octagonal	Inserted in the foot-rail brackets (6503); they are adjusted later. (*See Con. No. 53*)	
52	4	**Corner-post seat-end iron-panels*** (Fig. 187)	6501	M. I.	..	.....	..		In 2 pairs, each consisting of 3 pieces, shown and marked in the figures (a), (b) and (c), (b) being the piece next the front or platform, and (a) the piece toward the center of the car. The two pieces (a) and (b) are screwed to the corner-posts with 52 No. 14 x 1½ in. steel screws, the holes for the screws being under the covering piece (c), and fastened to the side-sills through tongues at the bottom on the other side of the panels with 24 lag screws 2 in. x ⅜ in., after which the covering pieces (c) are screwed to the corner-posts with 52 round-head, blued-steel screws No. 16 x 1½ in. There are in each:—	
					1	Groove	d	½ in. x ½ in.	In the covering piece (c) for the curtain-guides to slide in	
					1	Hole	e	⅜ in. diam.	In each panel piece (a) and (b) for seat bolt (9507)	
53	16	**Side-post seat-end iron-panel*** (Fig. 188)	6502	M. I.	..	.....	..		Each having:—	
					2	Grooves	a	½ in. x ½ in.	For the curtain-guides to slide in	
					1	Hole	b	⅜ in. square	For bolt 4⅜ in. long through side-post, with round-head on the outside	
					1	Hole	c	½ in. diam.	For side-post tie rod (6510)	
					1	Hole	d	⅜ in. square	For bolt 3¾ in. long through side-post, with countersunk-head on the inside.	
					2	Holes	e	⅜ in. diam.	For seat-bolt (9507)	
					4	Tongues	..		At the bottom on the inside (not seen) with holes in them for 64 lag screws, 2 in. x ⅜ in., to fasten the panels to the side-sills	
					2	Sockets	..		(Not seen) cast on the inside of the panels, corresponding to the foot-rail brackets (6503), Fig. 181, into which the round ends of the foot-rails are inserted, so that when the panels are fixed and tightened up, the foot rails are held securely in place. (*See Con. No. 51*)	
54	8	**Side-post tie-rods** (Not Ill.)	6510	W. I.	..	.....	..	7 ft. 3¾ in. x 7-16 in.	Are passed through hole (e) of the side-panel and side-post to and through the opposite side-post and side-panel, and tightened up with a nut at each end	
55	4	**Top-panel corner-plates** (Fig. 193)	6505	S. I.	..	.....	..	4¼ in. x 4¼ in. x 3¼ x 1-16 in.	Screwed to corner-posts, side and end top-panels with 32 No. 10 x 1 in. steel screws. Each one has	
					1	Hole	a	½ in. diam.	For platform-hood bracket (7505) bolt	Punch
56	4	**Sub-top-rail corner-plates** (Fig. 192)	6506	S. I.	..	.....	..	3 11-16" x 3 5-16" x 1¾" x 1-16"	Screwed to corner-posts, side and end sub-top-rails with 8 No. 10 x 1 in. and 24 No. 7 x ¾ in. steel screws	
57	4	**Side-sill wear-plates** (Fig. 194)	5507	M. I.	..	.....	..	18 in. x 2⅛ in. x 3-16 in.	Screwed to side-sills between the seat-end panels and in front of the corner-post panels with 132 No. 12 x 1 in. steel screws	
4		**Side-sill wear-plates** (Fig. 194)	5507	M. I.	..	.....	..	17 in. x 2⅛ in. x 3-16 in.		
14		**Side-sill wear-plates** (Fig. 194)	5507	M. I.	..	.....	..	14 in. x 2⅛ in. x 3-16 in.		
58	16	**Pillar-handle top-sockets** (Fig. 186)	6511	Bz.	..	.....	..		With 3 ears, and	
	4	**Pillar-handle top-sockets** (Fig. 184)	6511	Bz.	..	.....	..		With 2 ears, fitted to cavities (a) in the drip-rails (6021) and secured with 56 No. 9 x ¾ in. bronze screws; the 4 sockets with 2 ears being for the cavities at each end of the drip-rails	
59	12	**Pillar-handle middle-sockets** (Fig. 182)	6512	Bz.	..	.....	..		Screwed to corner-posts and the second and fourth side-posts from each end, with 12 No. 12 x 1¼ in. bronze screws, and further secured with the seat back arm-pivots (9505) going through holes (h) in the side-posts, Fig. 181, (*see Con. No. 43*) and to the corner-posts with 4 bolts 4⅝ in. x 5-16 in. with round beveled heads on the inside and bronze nuts on the outside	
60	2	**Guard-rails** (Fig. 169)	6026	A.	..	.....	..	27 ft. 0 in. x 2¾ in. x 1¼ in.	Are laid on the pillar-handle middle-sockets, between the side-posts and the pillar-handles, to which	
61	4	**Guard-rail guides** (Fig. 185)	6514	Bz.	..	.....	..		Have been previously screwed with 8 No. 12 x 1 in. bronze screws, one at each end of the guard-rails	
62	20	**Pillar-handles** (Fig. 174)	6025	A.	..	.....	..	4 ft. 0¾ in. x 1½ in. diam.	Are now passed through the pillar-handle middle-sockets, the guard-rail guides, and their top tapered ends fitted in the pillar-handle top-sockets, and secured in this position by their bottom ends being fitted in	
63	20	**Pillar-handle bottom-sockets** (Fig. 183)	6513	Bz.	..	.....	..		Which are screwed to the corner-posts with 4 No. 12 x 1¼ in. and 4 No. 18 x 1¾ in. bronze screws, and to the side-posts with 16 No. 12 x 1¼ in. bronze screws, and further secured to the side-posts with 16 bolts 3¾ in. x 5-16 in. with round beveled heads and bronze nuts, passing through holes (i) in the side-posts, Fig. 181. (*See Con. No. 43*)	
64	8	**Guard-rail catches** (Fig. 180)	6515	M. I.	..	.....	..		Screwed to the top of corner-posts and each third side-post from the end, over pockets (n), Fig. 181 (*see Con. Nos 38, 43*), with 32 No. 8 x ⅝ in. steel screws. When entrance to the seats is desired, the guard-rail is pushed up past the spring-finger, which then springing forward holds the rail secure; and when entrance to the seats is to be closed, the rail is lowered to rest on the pillar-handle middle-sockets	
65	8	**Guard-rail wear-plates** (Fig. 179)	6516	Bz.	..	.....	..	2½ in. x 1¼ in. x 1 in. x 1-16 in.	Are screwed to the guard-rail, with 16 No. 9 x ½ in. and 16 No. 7 x ½ in. bronze screws, where the rail rests on the top catch (6515)	
									The car body is now ready to receive the roof, which is described in Table 36 and illustrated by Plate VIII.	

Number of Distinctive Pieces	38	(Column 1)
Total Number of Pieces	286	(" 2)
Number of Bolts	92	(" 6 and 10)
Number of Screws, about	942	(" 6 and 10)
Number of Nails	(?)	
Total	1320 +	

* These are J. G. Brill Co.'s make.

LEGAL NOTES AND COMMENTS

EDITED BY J. ASPINWALL HODGE, JR., OF THE NEW YORK BAR*

Some Recent Decisions

STOCKHOLDERS' LIABILITY

In two cases just decided by the Supreme Court of the United States, a much mooted question upon which courts have differed, has been decided, and perhaps in a way which is binding upon the courts of all the States.

Each State in the Union has a different set of provisions in its statutes, and some times in its constitution, creating, restricting, and defining the liability of stockholders of an insolvent corporation for its debts. In some States, as in West Virginia, this liability is so restricted as to be almost obliterated, while in other States, *e. g.*, Kansas, the conditions which create the liability are numerous.

The highest courts in many of the leading States have frequently refused to enforce a stockholder's liability against their own citizens when it was claimed that such a liability arose out of the statutes of another State in which the corporation was organized.

This policy has been ably defended, and has been as ably criticised. It would seem that the decisions in the two cases referred to, (*Whitman vs. the Bank, advance sheets S., P. 506*), especially the latter, will compel a reversal of this policy, for the court holds that when the laws of a State in which a judgment is rendered against a corporation organized in that State provide that it shall be binding on the stockholders, the courts of every other State must give that judgment the same conclusive effect against a stockholder, who is sued, as if he had been a party to the action in which the judgment was obtained, and the only defenses which the stockholder can make are those which he is allowed to interpose in the courts of the State in which the judgment against the corporation was rendered. This would seem to overthrow the rule in such cases as *Marshall vs. Sherman, 148 N. Y., 79.*

X-RAYS

A novel scientific question has been raised in a recent case where an application was made to require a plaintiff in an action for personal injuries, to submit his neck to the action of the X-rays, in order that the nature and extent of his injuries might be ascertained. It would seem that where an examination of the person is allowed by the court, that certain mechanical devices may be used by the physician, as for example, a measuring tape, a magnifying glass, the stethescope, or the various devices used to throw light into the mouth, the eye, etc., but the court was up against a new question when it was asked to compel the plaintiff to allow the physician to use the X-rays. It was insisted, in support of the particular application made, that the court should take judicial notice of the fact that exposure to X-rays is not injurious to the subject. While denying the application on other grounds, the court expressed a doubt as to whether science is sufficiently far advanced to justify the court in taking judicial notice of the claimed harmlessness of the action of the ray. It was held that the application was not seasonably made, and that it was affirmatively shown that the person who was to apply the ray had sufficient knowledge and experience to apply it properly.

DAMAGES CAUSED BY DELAY

A case recently decided in England is of interest to the common carrier and the traveling public. An English barrister sued the Metropolitan Underground Road for the inconvenience, loss of time and necessary expenditure in cab hire arising out of the fact that after the defendant's railway line had become blocked, the company sold him a ticket and allowed him to board a train, which, after running a short distance, was stalled. The court held that he had stated a cause of action, although it was obliged to deny him relief on the ground that he failed to prove that sufficient time had elapsed between the happening of the accident which caused the block down the line and the time when he purchased the ticket and his train was despatched.

Apparently, the court held that it was the duty of the common carrier to have proper telegraphic facilities, and having these, to notify the stations along the line of a blockade and to refrain from selling tickets or despatching trains which would only tend to delay its passengers.

STREET RAILWAYS AND STREET ASSESSMENTS

The street railway companies are liable for assessments along with the abutting property owners for the cost of street improvements is a proposition recently reiterated in the case of *Shreveport vs. Prescott, 55 La. Ann., 1895.* This is in accordance with what appears to be the preponderance of authority. But the liability of the street railway company for anything above the nominal amount which may be assessed for actual benefits conferred upon the company by the improvement is generally determined by the presence or absence of provisions in the franchise or contract under which it obtains the right to occupy a portion of the street, creating a contractual liability.

It was held in *Norwood vs. Baker, 172 U. S., 269,* by the Supreme Court of the United States that any assessment upon a property owner for improvements which are not limited to the benefits conferred by the improvement upon the property was in violation of the constitution of the United States. This, of course, does not affect the provisions of a franchise which compels the railway company to pay for street improvements over and above the benefit they may confer upon the property of the company, but in the absence of such provision it limits the possible assessment to the actual benefit derived.

It is manifest that the ordinary street improvement, such as paving or curbing the street does not confer any great benefit upon a street car line which may be operating in its center.

CHARTERS, ORDINANCES, FRANCHISES, ETC.

NEW YORK.—Motive Power—Change—Abutting Property—Required Consent—Commission—Substituted Consent.

Under Laws 1890, chap. 565, sec. 100, providing that any change in the motive powers of a street railway must be consented to by the owners of one-half the abutting property, and in case such consent could not be obtained the determination of a commission appointed by the general term of the Supreme Court in favor of such motive power, when confirmed by the court, should be taken in lieu thereof, and that such consent should be obtained in the same manner as provided in sections 91 and 94 of the same act, which sections require that for the construction of a street railway the consent of the owners of one-half "in value" of the abutting property should be obtained, etc., a petition for a commission to authorize a change of motive power, alleging that the consent of the owners of one-half "in value" of the required property could not be obtained, was not insufficient because it did not show that the consent of the owners of one-half the "lineal front feet" of such property could not be obtained, since the evident intent of the Legislature was to conform the practice of obtaining the consent to a change in motive power to that required for the construction of a street railway.—(In re Rochester & L. O. Ry. Co., 64 N. Y., Suppl., 429.)

NEW YORK.—Pleading—Amendments—Misnomer of Defendant.

1. Under Code Civ. Proc., section 723, permitting amendments to pleadings upon the trial, or at any stage of an action before judgment, by adding or striking out the name of a party, or by correcting a mistake in the name of the party, plaintiff may be allowed to amend his complaint by correcting a mistake in the

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name of a corporation defendant after appearance, and before trial.

Same—Waiver of Misnomer.

2. Under Code Civ. Proc., section 1777, providing that a mistake in the corporate name of a party to an action is waived unless the misnomer is pleaded in the answer, or other pleading in defendant's behalf, a defendant who has waived such mistake by failure to plead it cannot complain of the allowance of an amendment to the complaint correcting a mistake in the name of a corporation defendant.

Courts—Jurisdiction—Domestic Corporations.

3. The operation of a railway by a corporation within the territorial jurisdiction of the municipal court of the city of New York is sufficient to constitute a residence by such corporation within the jurisdiction of said court, under Code Civ. Proc., section 341, giving the County Courts jurisdiction of actions against domestic corporations actually located within the county.

Appeal—Issues in Lower Court—Estoppel.

4. Where the cause was voluntarily litigated in the court below upon the theory that two city ordinances of different years, and affecting the rights of defendant, were identical, the plaintiff will not be permitted to claim on appeal that the question of their identity was not properly raised in the court below because one of the ordinances was not introduced in evidence.

Street Railroads—Times for Running Cars—Construction of City Ordinances.

5. Rev. Ord. City of New York, 1897, sections 595, 596, requiring city railroad companies "not running cars" on the surface of the streets of said city to run not less than one car every twenty minutes between the hours of 12 midnight and 6 o'clock a. m., under penalty of $100 for every neglect or refusal to comply with the ordinance, are applicable to a street railroad which did not begin to operate its cars, nor have any corporate existence, until the year 1892; said sections being identical with an ordinance of said city adopted in 1890, before said corporation was "running cars," and Rev. Ord., section 785, providing that, in so far as the revised ordinances are substantially the same as the ordinances existing at the time the former took effect, they shall be construed as a continuance of such ordinances, and not as new ordinances.

Appeal—Questions Not Raised Below.

6. The claim that Rev. Ord. City of New York, sections 595, 596, in regard to the running of street cars after midnight, do not apply to defendant, in the absence of proof that it ran cars or had tracks laid at the time when the revised ordinances took effect, cannot be made on appeal, when such point was not raised in the court below.

Ordinance Fixing Time for Running Cars—Violation—Evidence.

7. In an action to collect a penalty of a street railway company for its neglect to run cars every twenty minutes after midnight, as required by Rev. Ord. City of New York, sections, 595, 596, evidence that in 1892, by a consolidation of certain street railroads, defendant became the owner of the road, tracks, etc., on W. avenue; that during the daytime of the period in question cars bearing defendant's name were run along said avenue, and that no cars except those bearing the name of defendant were operated thereon; and that on a day named in 1898, from half-past 1 until half-past 5 o'clock in the morning no cars passed a police officer, whose beat extended along said avenue, is sufficient to support a judgment for the penalty prescribed for the violation of said ordinance.—(City of New York vs. Union Ry. Co., of city of New York, 64 N. Y. Suppl., 483.)

LIABILITY FOR NEGLIGENCE.

NEW YORK.—Negligence—Extent of Injuries—Evidence.

1. Where plaintiff, an actress, suing for injuries sustained, testified that on joining her company, some weeks after the accident, she was so ill as to seldom be able to attend rehearsals, and was under a doctor's care all the time; that her manager well knew how ill she was, and that she was finally compelled by sickness to stop work, it was error to exclude testimony of the manager as to what he had observed as to her physical condition during that period.

Same.

2. Where plaintiff had testified that she was forced to disband her theatrical company through ill health due to injuries sued for, and not because of her incompetency as an actress, it was error to exclude the testimony of her manager as to why the company was disbanded.—(Farrell vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 709.)

NEW YORK.—Negligence—Instructions.

1. In an action for injuries caused by plaintiff's wagon colliding with a street car while he was driving across defendant's tracks, an instruction that if, just before the accident, the wagon was driven alongside the track and it was turned into the track in front of the car, the verdict must be for the defendant, was properly refused, since the turning into the track might have been far enough in front of the car to have given the gripman ample time to stop the car and prevent the accident.

Same—Special Damages—Allegation—When Necessary.

2. Where injuries for which recovery is sought do not necessarily result from those described in the complaint, they must be alleged as special damages; and an injury to plaintiff's eye could not be recovered for on an allegation of injury to the head and brain, since it did not necessarily result therefrom.—(Geoghegan vs. Third Ave. R. Co., 64 N. Y. Suppl., 630.)

NEW YORK.—Excessive Damages—Personal Injuries.

Plaintiff, a teacher, was injured by the sudden stopping of defendant's street car, on which she was a passenger, the injury being a dislocation of a cartilage in each knee, with other injuries to her body. She expended $1,670 for medical services, and was confined to her bed about ten weeks. At the time of the trial, eighteen months after the accident, she could not go up and down stairs without pain, and, in consequence of her condition, had to give up her position of general superintendent in a school. Held, that a verdict of $15,000 should be set aside as excessive.—(Kraemer vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 619.)

NEW YORK.—Malicious Prosecution—Evidence—Judicial Proceedings.

An action for malicious prosecution will not lie against a defendant for having illegally arrested plaintiff without a warrant, and having brought him before a police court, where he is discharged without the filing of a complaint; an essential element of malicious prosecution being a commencement of judicial proceedings.—(Barry vs. Third Ave. R. Co., 64 N. Y. Suppl., 615.)

NEW YORK.—Personal Injuries—Negligence—Evidence.

In an action against a street railroad company for injuries alleged to have been caused by snow or ice thrown by a sweeper used by defendant to clear the snow from its tracks, in the absence of proof that the snow or ice which had caused the injury and which plaintiff said came from the direction of the sweeper, did in fact come from the sweeper, and in the absence of proof that this was the result of negligence which could have been avoided, a verdict for plaintiff cannot be sustained.—(Connor vs. Metropolitan St. Ry. Co., 63 N. Y. Suppl., 509.)

NEW YORK.—Injuries—Negligence—Conflicting Evidence.

1. Where, in an action for personal injuries from being struck by a street car, the evidence, both as to defendant's negligence and plaintiff's contributory negligence, is conflicting, and sufficient to sutain a verdict for either party, a judgment entered on the jury's verdict will not be disturbed on appeal, as not supported by sufficient evidence.

Same—Speed of Car.

2. Where, in an action for injuries for negligent management of a street car, defendant claimed that the car was going but eight miles an hour, and plaintiff had already shown that it took 80 ft. in which to stop it, plaintiff's evidence that but 12 ft. would be required in which to stop a properly equipped car going eight miles an hour was admissible.—(McDonald vs. Brooklyn Heights R. Co., 64 N. Y. Suppl., 480.)

NEW YORK.—Accident at Crossing—Contributory Negligence.

Plaintiff, a motorman, in charge of an electric car, when about 750 feet from a railroad crossing, saw a freight train standing on defendant's track about 315 ft. from the crossing. At this time his car was moving at the rate of 12 miles per hour, and continued at that speed until within 125 ft. of the crossing, when he discovered that the train was backing toward the crossing and that there was danger of a collision. He reversed his power, put on the brake, and thereby reduced the speed, but could not bring his car to a stop before reaching the crosing, owing to ice on track, and, as a result, it struck the train, and plaintiff was injured. Held, that he was guilty of contributory negligence as a matter of law.—(Einsfield vs. Niagara Junction Ry. Co., 63 N. Y. Suppl., 563.)

NEW YORK.—Appeal.

Where, in an action against a street car company, defense was supported by testimony of two disinterested witnesses, a judgment for plaintiff will not be held against the weight of evidence where, in addition to her own evidence, she was entitled to the benefit of the presumption arising from failure of defendant to produce its motorman and conductor, who saw the act in question, without sufficient explanation of their absence.—(Staib vs. Union Ry. Co. of New York City, 62 N. Y. Suppl., 755.)

NEW YORK.—Appeal—Review—Dismissal of Complaint—Presumption.

1. In reviewing a judgment dismissing a complaint for insufficiency of evidence, all evidence offered by plaintiff must be taken as true.

Accident at Crossing—Evidence of Contributory Negligence.

2. A truckman, seeing an electric car standing about 100 ft. away, drove across the track in front of it, and was struck and injured by it. He had a lantern in front of his truck, throwing the light forward toward the horses. He did not see the car after he started to drive across the street. Held, that the question of his contributory negligence was for the jury.—(Lowry vs. Metropolitan St. Ry. Co., 62 N. Y. Suppl., 743.)

NEW YORK.—Injuries to Wife—Damages—Medical Attendance—Evidence.

1. In an action by a married woman for injuries, where it appears that she is living with her husband, and is not possessed of any private means or engaged in any separate business, evidence of the physician who attended her as to what his services were worth and what he was paid was incompetent.

Same.

2. In an action by a married woman for injuries, it was error to permit a physician to testify to plaintiff's physical condition as he found it two years after the injury, where it appears that the physician who attended her at the time of the injury did not discover the condition subsequently found to exist, and it further appears that she had, since the injury, given birth to two children, and that the condition found to exist on the second examination might have been caused by either of the intervening confinements. —(Sweeney vs. Union Ry. Co., of New York City, 64 N. Y. Suppl., 453.)

NEW YORK.—Appeal and Error—Case on Appeal—Insertion of Evidence.

1. An appeal from an order denying a motion for a new trial on the minutes raises the questions whether the verdict is excessive or contrary to the evidence, and hence, where plaintiff recovered for injuries, he is entitled to have all the evidence showing the extent of the injury, and the time he was disabled thereby, inserted in the case on appeal.

Same—Certificate as to Evidence—Review of Facts.

2. A certificate that a case on appeal contains all the evidence, only has place and effect where it serves as the only notice that review of the facts is sought, and is therefore unnecessary on an appeal from a judgment on a verdict of the jury and from an order denying a new trial, since such an appeal raises the question of the sufficiency of the evidence to sustain the verdict, and notice of the appeal is notice that the facts will be reviewed.—(Gibson vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 396.)

NEW YORK.—Attorney's Lien—Attorney and Client—Fees of Attorney—Value of Cause of Action—Compromise.

1. Plaintiff in an action for damages agreed to pay his attorney one-third of any sum for which the cause might be adjusted. A compromise was made between the parties, by defendant paying plaintiff a stated sum, and also agreeing to pay plaintiff's attorney any claim or lien on the cause of action which he might lawfully establish. Held, that the sum paid plaintiff in compromise was conclusive on the defendant as the value of the cause of action, in determining the amount to be paid plaintiff's attorney by defendant, and not such sum as might be established by a continuance of the action.

Same—Calculation of Fee.

2. Where plaintiff's attorney was entitled to one-third of any sum for which the cause might be adjusted, and it was compromised by defendant paying plaintiff $2,600 as a net payment, and agreeing to pay plaintiff's attorney the amount due him under such settlement, the attorney was entitled to a payment equal to one-third of $2,600 only, and not to a payment equal to one-half of $2,600, though, under his original agreement with plaintiff to receive one-third the amount recovered, his fee would be equal to one-half the net amount received by plaintiff.

Attorney's Fees—Stipulation—Summary Proceedings.

3. Code Civ. Proc., Sec. 66, as amended by Laws 1899, provides that an attorney shall have a lien on his client's cause of action, and that the "court upon the petition of the client or attorney may determine and enforce the lien." Held, not to give the court jurisdiction by summary order to enforce a compromise stipulation between plaintiff and defendant whereby defendant agreed to pay any lien which plaintiff's attorneys might establish on plaintiff's cause of action.

Same—Attorney's Lien—Enforcement.

4. Where plaintiff's attorney had a lien on his client's cause of action, and the case was compromised by defendant making plaintiff a cash payment and promising to pay plaintiff's attorney the amount of his lien, which he afterward refused to do, the attorney had the right to proceed to judgment in the action for the protection and enforcement of his lien.—(Pilkington vs. Brooklyn Heights R. Co., 63 N. Y. Suppl., 211.)

NEW YORK.—Attorney and Client—Attorney's Fees—Summary Proceedings.

A summary proceeding will not lie to enforce an agreement whereby a defendant, as part of a compromise, promised to pay the plaintiff's attorney his costs and fee.—(Schriever vs. Brooklyn Heights R. Co., 63 N. Y. Suppl., 217.)

NEW YORK.—Negligence—Driving in Front of Street Car. Where plaintiff saw a street car approaching about 250 ft. away, and drove on the track in front of it for a considerable distance, making no attempt to observe its approach, and his wagon was struck by the car as he was turning off the track, he was guilty of negligence.—(Pechesky vs. Metropolitan St. Ry. Co., 62 N. Y. Suppl., 478.)

NEW YORK.—Infants—Sui Juris—Negligence.

1. A 9-year-old girl testified that on stepping from the curbstone she saw a street car coming toward her; that she looked up because she thought she might get run over if she did not look; that she knew the car was a dangerous thing; that when she saw the car coming she thought she could get across; and that, as she stepped over the first rail, she knew nothing more. Held, that she was sui juris.

2. Evidence—Presumptions. Where a child was injured at a crossing by a street car, and the motorman was not called as a witness, it raises a presumption of his negligence.

3. Injury to Pedestrian. Plaintiff, 9 years old, attempted to cross a street in a well settled portion of a city, at a crosswalk, in front of a car about 127 ft. distant. When the motorman saw her, he brought the car to a standstill within 10 ft. or 15 ft. of the crosswalk where she was struck. Held, that the refusal of an instruction which assumed that there was nothing in the situation to justify her in the belief that the car would be brought under control before it arrived at the walk was proper, as at variance with the evidence.

4. Trial—Instructions. A refusal of a request to charge, where the court had already charged the matters requested so far as they were established by the evidence, was not error.

5. Contributory Negligence. Plaintiff's failure to defer crossing until the car had passed, or to continue to watch the car, did not constitute contributory negligence as a matter of law, but was a question for the jury.—(Hicks vs. Nassau Elec. R. Co., 62 N. Y. Suppl., 597.)

NEW YORK.—Collision—Action for Injuries. Plaintiff could not recover for injuries resulting from his wagon being struck by defendant's cable car, where he saw the car in time to stop his wagon, but miscalculated the distance, and attempted to drive in front of the car.—(Petri vs. Third Ave. R. Co., 62 N. Y. Suppl., 315.)

OREGON.— Pleading — Speed — Regulation — Ordinance — Amendment—Evidence.

1. Where a complaint to recover for the death of a minor child alleged that defendant was operating its street car at a dangerous and reckless rate of speed, there was no abuse of discretion in allowing an amendment that such a rate of speed was in excess of that permitted by a city ordinance.

2. Evidence of particular instances in which street railway cars were operated at a given speed is not admissible to show the speed of a car at the time of a collision with a child.—(Wade vs. City & Suburban Ry. Co., 59 Pac. Rep., 875.)

PENNSYLVANIA.—Collision With Vehicle—Contributory Negligence.

1. A driver on a narrow street, only 20 ft. wide from curb to curb, on which there were two tracks of an electric street railway, was overtaken by a car going in the same direction as he was driving. He turned onto the other track, driving along it up a hill. When the car approaching him from behind was beside his wagon, another car came suddenly into view from the other side of the hill, in front of him on the track on which he was driving, and ran into him. Held, that the driver was not guilty of contributory negligence, as a matter of law, in not stopping and waiting until the first car had passed him, and then returning to the track which he had left.

2. By the necessity of turning out of the track, the driver was suddenly placed, without fault on his part, in a position of danger; and, in his effort to extricate himself, he could not be held to the use of the best judgment.—(Cannon vs. Pittsburg & B. Traction Co., 44 Atl. Rep., 1089.)

PENNSYLVANIA.—Injury to Boy—Negligence—Briefs—History of Case.

1. Nothing should be stated in the history of the case not justified by the evidence.

2. The motorman, on discovering a boy on the step of the platform, should stop, and take him inside, or put him off; and his negligence in not doing so, intensified by his knocking on the window and kicking on the closed side, manifestly frightened the boy.

PENNSYLVANIA.—Collisions—Negligence. Where the speed of a street car is not unreasonable, and the motorman spares no effort to check it, so as to avoid collision with a person, who,

while proceeding near the track, suddenly attempts to cross ahead of the car, the company is not negligent.—(Sauers vs. Union Traction Co., 44 Atl. Rep., 917.)

PENNSYLVANIA.—Tipping Over Post—Negligence—Evidence—Instruction—Damages—Pain.

1. The question of negligence, where the trolley of a car left its wire, struck a span wire between two posts, and pulled one of them down on plaintiff, is for the jury, it depending on whether there was a useless and abandoned wire forming a loop on the span wire, in which the trolley caught, though only one person, who was not a dull or unveracious witness, testified to its presence, while the superintendent and several of the employees of the company testified that the loop was not there at the time of the accident.

2. An instruction authorizing an allowance in damages for pain and suffering, by way of compensation, is not error; there being no suggestion that pain and suffering had a positive price or market value.—(Bamford vs. Pittsburgh & B. Traction Co., 44 Atl. Rep., 1068.)

PENNSYLVANIA.—Moving Disabled Trolley Car—Negligence—Damages—Pain and Suffering.

1. Where the trolley of a disabled car, which was being pushed by another car, jumped its wire, striking and breaking a cross wire, thus causing the accident to plaintiff, the question of negligence is for the jury, on testimony that the proper course was to tie down the trolley of the disabled car, and that the conductor thereof was told by the conductor of the other so to do, but refused or neglected.

2. Pain and suffering are a distinct item for which damages may be awarded in a personal injury case.

3. The Supreme Court will grant a new trial on the ground of excessive damages, under Act May 20, 1891 (P. L. 101), only in very clear cases of wrong or injustice, which the court below should have remedied.—(Schenkel et ux. vs. Pittsburgh & B. Traction Co.)

PENNSYLVANIA. — Collision — Contributory Negligence. Plaintiff's team being struck by a car on the down track, coming from the direction in which he had been going on the up track, just as he turned onto the track, and the testimony being merely that he did not see or hear, and not that he looked, and it being a clear day, and manifest that he could have seen it for a long distance away if he had looked, contributory negligence prevents recovery.—(Bolhmer vs. Pittsburgh A. & M. Traction Co., 45 Atl. Rep., 126.)

PENNSYLVANIA.—Contributory Negligence. Plaintiff is guilty of contributory negligence where, after stopping his horse 10 ft. or 12 ft. from a street car track, whence he could see one-fourth of a mile, and seeing no car, he attempted to go forward, but, on finding his team stalled, backed up 10 ft. or 12 ft., and then went forward with a spurt, not looking again, with the result that he was struck by a car.—(Kern vs. Second Ave. Traction Co., 45 Atl. Rep., 125.)

PENNSYLVANIA.—Injury to Person in Street. Nonsuit is properly granted in case of one who, though seeing a car on the track, attempted to cross, she testifying that as she went to the edge of the track she saw the car was moving, and that the dasher was in front of her, and that she was at the side of car when struck thereby, as she must have been struck by her coming in contact with the car by her voluntary act.—(Walsh vs. Hestonville M. & F. Pass. R. Co., 45 Atl. Rep., 322.)

PENNSYLVANIA.—Action for Personal Injuries—Instructions—Damages.

1. In an action against a railway company to recover for personal injuries alleged to have been occasioned by its negligence, it is not error to state to the jury that it was defendant's duty to furnish reasonably skilled and competent men to operate its cars, and "that is just where the plaintiff claims the defendant failed in its duty."

2. In an action against a railway company to recover for personal injuries, an instruction authorizing the jury, in assessing plaintiff's damages, to consider the expenses incurred as a consequence of the injury, the inconvenience and suffering naturally resulting from it, and the loss of earning power, whether temporary or permanent, consequent on the character of the injury, without explanation of the evidence or law applicable to either item, is inadequate.—(Todd vs. Second Ave. Traction Co., 44 Atl. Rep., 337.)

TENNESSEE.—Personal Injuries—Accident Between Crossings—Right of Way—Res Gestæ—Credibility of Testimony.

1. Plaintiff, who had been struck by a street car, testified in an action for damages therefor that he did not look and listen before attempting to cross the track, but in a second trial he testified that he did so look and listen. *Held*, that the jury, and not the court, must determine the credibility of his testimony.

2. The plaintiff was struck by a street car, and about fifteen minutes was occupied in extricating and caring for him at the place of the accident, when the motorman stated that he saw plaintiff, but thought he would get off the track. *Held*, that the statement was no part of the res gestæ.

3. Between street crossings, a street railroad company's right of way is superior to, but not exclusive of, the right of a pedestrian.—(Citizens' St. R. Co. vs. Howard, 52 S. W. Rep., 864.)

UTAH.—Personal Injuries—Liability—Negligence—Custom—Instructions—Reasonable Care.

1. However unusual the method of a common carrier, such as a street railway company, in starting its cars, if that method is dangerous, and its use violative of the high degree of care which the carrier is required to observe regarding its passengers, and in the use of that method a passenger is injured, the carrier is liable.

2. In an action for damages for personal injuries alleged to have been caused by the defendant starting one of its cars, on which the person injured was a passenger, in a reckless, careless, and negligent manner, the question for the jury is whether or not in this particular instance the car was started in a negligent, dangerous, or improper manner; and an instruction which, in effect, charges the jury that, if the officers of the defendant, by experience, were satisfied in their own minds that the method used in starting the car was reasonably safe, defendant would not be liable, is erroneous.

3. In such a case, an instruction that "the defendant, being a carrier of passengers for hire, the law imposes upon it a reasonable degree of care and foresight to prevent injuries to persons lawfully traveling in its cars," is defective in not defining to the jury what, under the law, a reasonable degree of care is.—(Dickert vs. Salt Lake City R. Co., 50 Pac. Rep., 95.)

UTAH.—Damages—Personal Injuries—Evidence—In Rebuttal—Contributory Negligence—Instructions—Negligence—Further Instructions.

1. In an action for damages for personal injuries caused by being run into by a street car, it is proper for plaintiff to prove in rebuttal a statement made by defendant's witness, who was motorman, immediately after the accident, at the place where it occurred, and in the presence of plaintiff and defendant's agents in charge of the car, which statement is inconsistent with the testimony of such witness from the stand.

2. Although plaintiff may have been negligent, yet if nevertheless the defendant could, by the use of proper and ordinary care, have prevented the injury, an instruction that "if in the hurry of the moment, or in a moment of forgetfulness, the plaintiff attempted to cross the track, without exercising that care which a man of ordinary prudence ought to exercise under the circumstances, he was guilty of contributory negligence, and cannot recover," is properly refused.

3. In such a case, an instruction that "if you believe from the evidence that the defendant's motorman had the least opportunity to avoid the accident after the negligence of the plaintiff, and failed to use all reasonable means to avoid the same, the defendant would be guilty of negligence, and would be liable," is properly given.—(Shaw vs. Salt Lake City R. Co., 59 Pac. Rep., 552.)

VIRGINIA.—Street Railway Crossings—Injury from Low Trolley Wire—Contributory Negligence.

1. Where plaintiff, a brakeman on a railroad crossed by an electric street railway, knew that the trolley wire sagged so low that it was necessary to stoop in order to pass under it with safety while on the top of the car, his ignorance of the danger attending contact with an electric wire in no way excused his fault in failing to exercise that reasonable care which would have enabled him to pass beneath the wire with safety.

2. An instruction that, though plaintiff was guilty of negligence that contributed to the accident, he could recover if the defendant, the street railway, could have, by ordinary diligence, avoided the accident, was not applicable to the facts.

3. Where a brakeman on a railroad crossed by defendant electric street railway attempted, in the performance of his duties, to pass from one car to another, while passing under the defendant's trolley wire, and was struck by the wire, which sagged to within a few feet of the top of the car, he cannot recover for such injury, though the defendant was negligent in so maintaining its wire over the railroad.—(Danville Street Car Co. vs. Watkins, 34 S. E. Rep., 884.)

VIRGINIA.—Action for Injuries—Trial—Instructions—Objections—Waiver—Pleadings.

1. Where the evidence in an action for injuries caused by defendant's alleged negligence in running its electric cars was conflicting, an erroneous charge that plaintiff was entitled to recover if her injury "was caused by defendant's servants," and without want of ordinary care on her part, was not cured by a subsequent correct charge that the mere fact that the injury was caused by

defendant's car would not entitle her to recover unless it was also shown by a preponderance of evidence that defendant was negligent.

2. It was error to charge that though plaintiff, in stepping on the track, failed to look and listen, she could recover, if by looking or listening she could neither have seen nor heard the approaching car, where there was no evidence on which it could be predicated.

3. An objection that an instruction assumes facts not in evidence is waived where instructions given at the request of the objecting party assume the same facts.

4. A complaint which alleges that plaintiff was struck by defendant's electric car while she was on the track, "upon which she had just stepped," is demurrable, since it conveys the idea that the collision was simultaneous with the plaintiff's act in stepping on the track, and therefore shows contributory negligence.—(Richmond Traction Co. vs. Hildebrand, 34 S. E. Rep., 888.)

PATENT DECISIONS

Patents—Validity and Infringement—Electric Railway Contact Devices.—The Anderson patent, No. 412,155, for an improvement in electric railway contact devices, consisting substantially in interposing metallic spring brushes between the forks of the trolley arm and the hub of the contact wheel, so as to encircle the spindle and bear upon the end of the hub, for the purpose of transmitting the current from the wheel to the trolley arm, construed, and *held* to show meritorious and patentable invention over the prior devices of the Heysinger patent, No. 395,607, and the Vandepoele patents, Nos. 396,310, 397,451 and 408,638; and also *held* infringed.—(General Electric Co. vs. Rahway Elec. Light & Power Co., 96 Fed. Rep., 464.)

PATENT DECISION.—Patents — Infringement — Trolley Tracks.

Claim 1 of the Coburn patent, No. 365,240, for an improved trolley track, as narrowed by amendment, while the application was pending in the Patent Office, to meet the objection of want of novelty and invention, covers only the specific device described, which consists of a tube "having the lower edges curved in toward the median line, and then turned upward, so that the bottom of the tube has a rounded trough at each side of a longitudinal central opening," and is not infringed by a tubular track similar in other respects, but having the sides turned in at right angles, leaving a flat surface for the track on each side of the opening, and fairly adapted to rollers with flat faces.—(Coburn Trolley-Track Mfg. Co. vs. Chandler et al., 97 Fed. Rep., 333.)

The Manhattan Railway Company, of New York, in the building of its mammoth steam-electric power station, has awarded to the Harrisburg Foundry & Machine Works, the contract for the engines to operate the exciter dynamo in its new Seventy-seventh Street power house. Ordinarily an order for engines simply to operate exciters would be a small affair, but in this case, on account of the huge proportions of the plant, it amounts in the aggregate to 1600 hp, quite a power plant in itself. This was an order that attracted unusual attention among both users and builders of engines, for the new station, where the engines are to be installed, is designed to be second to none in the completeness of its equipment, and no pains were spared in the selection of the very best machinery of all types for the various services required.

The exciter engines are four in number, each of 400 ihp capacity, each direct connected to a 250-kw direct-current dynamo of the Westinghouse Electric & Manufacturing Company's make. These dynamos have eight poles, are wound for a 1000 amps. at 250 volts, and are guaranteed for an efficiency of 93 per cent.

The Harrisburg engines are of the tandem compound type, the cylinders being 14 ins. and 25 ins. diameter by 18 ins. stroke. They are to operate at a speed of 200 r. p. m., with 150 lbs. steam pressure condensing.

Improvement in Bergen County.

The opening of the new Hackensack line of the New York & New Jersey Railway & Ferry Company, the new name of the Bergen County Traction Company, was chronicled in the issue of the STREET RAILWAY JOURNAL for June 23. The company is also making a number of additions to its power station and rolling stock. In the power station, which is at Edgewater, the company is placing two new batteries of boilers of 750 hp each, or a total of 1500 hp, together with a new generator of equal capacity. This gives an additional power greater than the entire output of the old plant. The boilers will supply the necessary steam for a cross-compound Hamilton-Corliss engine of about 1500 hp. The company also contemplates making a further increase next December. This would have been done at the present time, but for the inability to secure machinery from the manufacturers.

New Publications

Historic New Hampshire. 62 pages. Published by the Exeter, Hampton and Amesbury Street Railway Company. Illustrated.

This interesting pamphlet contains much historical information regarding the territory covered by the lines of the company, and describes in a pleasant manner the various "sights" which may be observed by the passengers on the road. Although intended primarily for these patrons, a complete, illustrated description of the power plant, etc., is given at the end. Numerous half-tones are distributed throughout the text, and a map of the railway is included.

Trolley Trips In and About Fascinating Washington. By Katharine M. Abbott. Published by J. F. Jarvis, Washington, D. C. 127 pages. Illustrated. Price 10 cents.

This entertaining little book is quite a complete guide to the public buildings and other points of interest around the capital, as well as being very useful to those who wish to find the pleasantest and most convenient way of getting around. The principal goals of the sightseer are well illustrated and described. In the back is found a folding map of the city with the various trolley lines designated thereon, and the back cover contains a map of the city and suburbs.

Railroad Construction, Theory and Practice. By Walter Loring Webb. Published by John Wiley & Sons, New York, 46 pages. Illustrated. Price $4.00.

Intended for a text-book and not a reference book, this volume is perhaps of less value to the practical engineer than to the student; but it may well find its way to the engineering office on account of its concise explanations and numerous references to original scientific papers. The parts of the book devoted to practice have necessarily been largely taken from such papers, and, with possibly the single exception of the chapter on tunnels, represent the most modern methods and figures. It is unfortunate that nothing is said about track in paved streets and bonding, although the subject of street railways is not supposed to be covered. The last quarter of the book is composed of tables, and an ingenious cardboard slide rule is found in a pocket on the inside of the back cover. The slide rule is intended for the computation of complicated earthwork problems, but the author fails to warn the student against too free a use of it in actual calculation. Many of the tables have been specially computed, and their excellent typography makes them a feature of the volume.

Modern Electric Railway Motors. By George T. Hanchett, M. E. Published by Street Railway Publishing Company, New York City. 200 pages. Illustrated. Price $2.00.

This book relates entirely to the description, design and management of electric railway motors, the author assuming from the first that the elements of electricity and magnetism have been previously understood. Although, perhaps, not intended primarily for a text-book, the arrangement is such that it would prove satisfactory in class-room work. The subject is treated in a strictly up-to-date manner, the latest apparatus, both American and foreign, being described, as well as a few of the older motors which are still in use. The excellent educational method of comparing the advantages and disadvantages of each set of systems or apparatus as it is explained is pursued throughout the work, and all abstract descriptions of the various types of fields, armatures, etc., are invariably followed by references to actual machines, thus fixing in the mind of the reader their application. The chapter on management and repair contains many useful hints for the car house and shop; and that on design, with its complete calculation for a modern type of motor, although necessarily not exhaustive, will be found of service to those entering this field. A folder in the back, giving authentic dimensions and other important data of all the best makes, will be welcome to both manufacturer and railroad man. The illustrations are numerous and good, and what is said is well said.

As an evidence of progress in Western engineering, it may be noted that the city engineer of Chicago recently placed with the Bethlehem Steel Company an order for a hollow-forged shaft to replace a breakdown in the North Side pumping station at that city. The new shaft, which measured 13 ft. 8½ ins. in length, 19 ins. in diameter, and weighed close to 10,000 lbs., was booked on May 30, and, under special emergency instructions, was hollow-forged, annealed and rough-machined in time to go forward June 9.

Many of the power stations in Chicago and other Western cities are equipped with shafts of this description, but this is the first time a hollow forging has been specified for water works engines in that section of the country.

Steel Rolling Doors

The cuts on this page illustrate a type of door which is peculiarly adapted to requirements of a car house. The manufacturers have increased its value for such uses by the addition of several ingenious devices which automatically insure a continuous trolley wire when the door is open, without in any way interfering with its operation.

The detail drawings show this arrangement; one with the door open, the other with it closed. The trolley wires on both the outside and inside are fastened to insulated blocks (*c*, *c* in the figure) which are connected by means of a wire running around the roller on which the door is coiled, and through a hole in the wall of the building. When the door is open the angle bar (*b*) fastened at right angles to the lowest segment fits over the guides (*a*, *a*), and forms a continuous path on which the trolley may run. To remove the strain from the blocks (*c*, *c*) guy wires, with turn buckles, are run out a few feet to the trolley wire from the wall.

The roller for the door is supported on strong brackets, and is revolved by means of an endless hoist chain and train of gears. As the sides require only a small groove to run in, every portion of the space is economized. When the door is up the entire opening is available. It is claimed that no matter how large this opening may be, it can be similarly treated, a door being now in process of construction which is 36 ft. wide by 20 ft. high, weighs 6200 lbs., and is probably the largest ever built.

A photograph of the car house of the Sioux City Traction Company, Sioux City, Ia., is reproduced to show the general appearance of the equipment in operation.

The doors above described are made by the Kinnear Manufacturing Company, Columbus, Ohio, which is the sole manufacturer.

CAR HOUSE AT SIOUX CITY

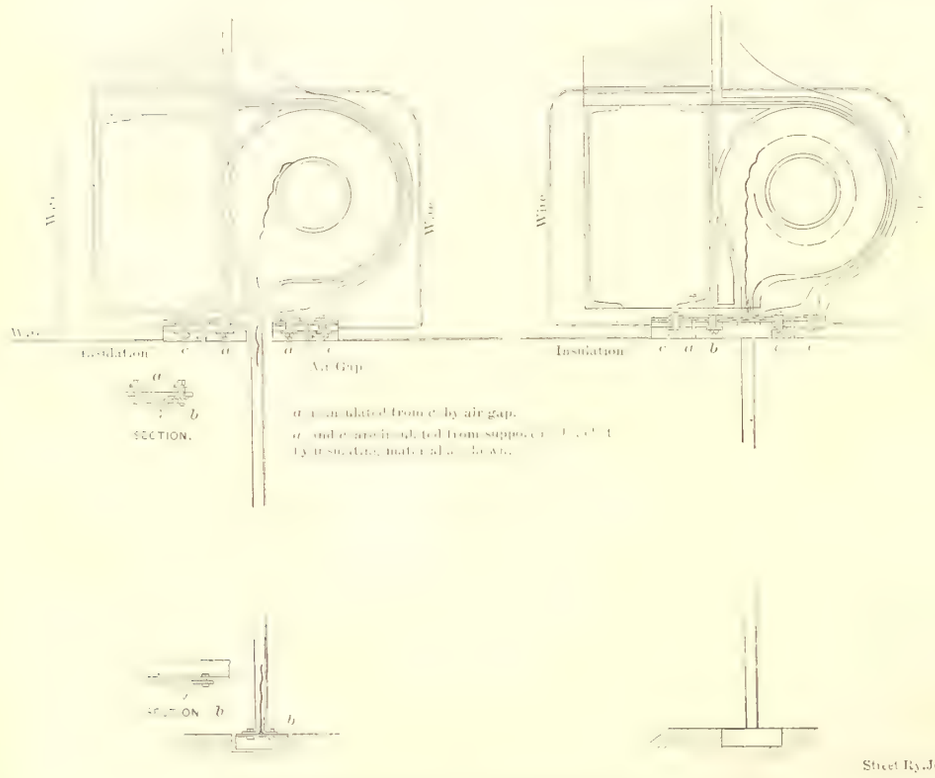


DIAGRAM SHOWING ARRANGEMENT OF DOORS

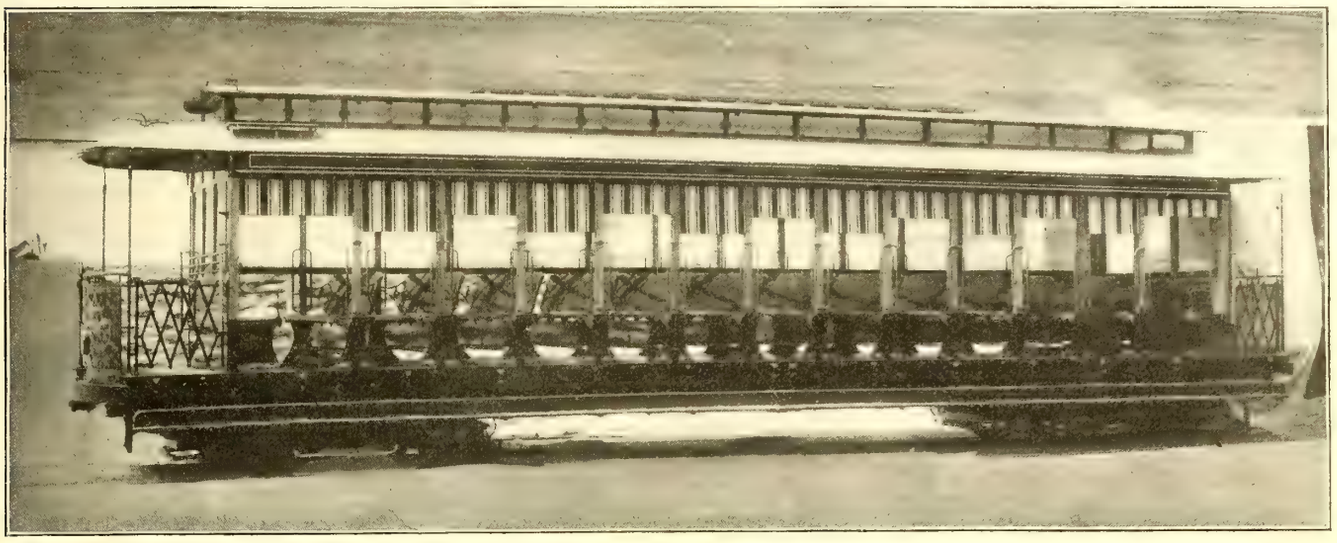
Some Recent Foreign Orders

The Morris Electric Company has been responsible for quite a large proportion of the exports of electrical apparatus which the daily papers have been mentioning for the past six months. Among other contracts which this company has made, and to which material has been shipped during the past six months, has been the supply of all the trolley, feed and span wire for the equipment of the Havana Street Railway Company. This company, as is well known, is building a large system in the capital of Cuba, and the feed wire contracts alone, it is said, involve an expenditure of over $200,000. For the same road the Morris Company has also filled an order for 2200 iron poles with brackets, fittings and appliances, 45,000 ft. of iron standard span wire, and 60 carloads of terra cotta ducts. These orders were placed with the Morris Company by George F. Greenwood, general manager of the Havana Street Railway Company. Two other railway companies for which Mr. Morris and the Morris Electric Company have supplied a large part of the material have been the Federal Street Railway Company, of Mexico City, and the Lisbon Tramways Company, of Portugal, both of which are controlled by the London bankers, Wernher, Beit & Company.

The Morris Company has also done a large amount of other foreign business in Europe, Africa and South America.

Large Open Cars

The engraving given herewith shows a fourteen-bench open car recently built for the Buffalo Railway Company, Buffalo, N. Y., by the J. G. Brill Company. These cars are interesting on account of their great size and the fact that they are mounted



LONG OPEN CAR FOR BUFFALO

on No. 27-F trucks. They are driven by four G E-57 motors ,and weigh without equipments 24,500 lbs. The trucks weigh about 5500 lbs. each. They are equipped with electric brakes and have electrice headlights. Bronze trim is used throughout, except for the grab handles, which are of malleable iron. There are two Dedenda gongs. Brill gates inclose the platforms, and the curtains when down reach to the floor.

The peculiar forms of the grab handles and inside guard rail are due to the great size of the cars. They are 41 ft. 10 ins. over the corner posts. Having a platform 3 ft. 8 ins. wide, they measure 49 ft. 2 ins. over the dashers. The extreme width is 8 ft. 2½ ins. The running boards are 19½ ins. from the head of the rail, with a 17-in. riser. The width gives 7 ins. more space on a seat than is usually allowed for five persons, making it possible by tight squeezing to put six passengers on a seat, although the nominal seating capacity of the whole car is but seventy. The step or running board is divided or closed in the centre and closes against the side of the car. The trolley board is insulated from the body of the car and the sound of the trolley deadened by the use of rubber.

Smokers will find the cars provided with one unusual little convenience—a match striker on the post. In designing these cars the management intended to provide seating capacity sufficient for all the passengers the cars were to carry, and made no provision whatever for standing room.

The New York & New Jersey Railway & Ferry Company, of Undercliff, N. J., has just purchased a large number of fine open cars, each equipped with four G. E. 67 motors, and mounted on Peckham 14 B 3 trucks. All trucks are fitted with the Price momentum brake, built by the Peckham Company, and which has proved very efficacious on the many grades on the line. Arc headlights are used.

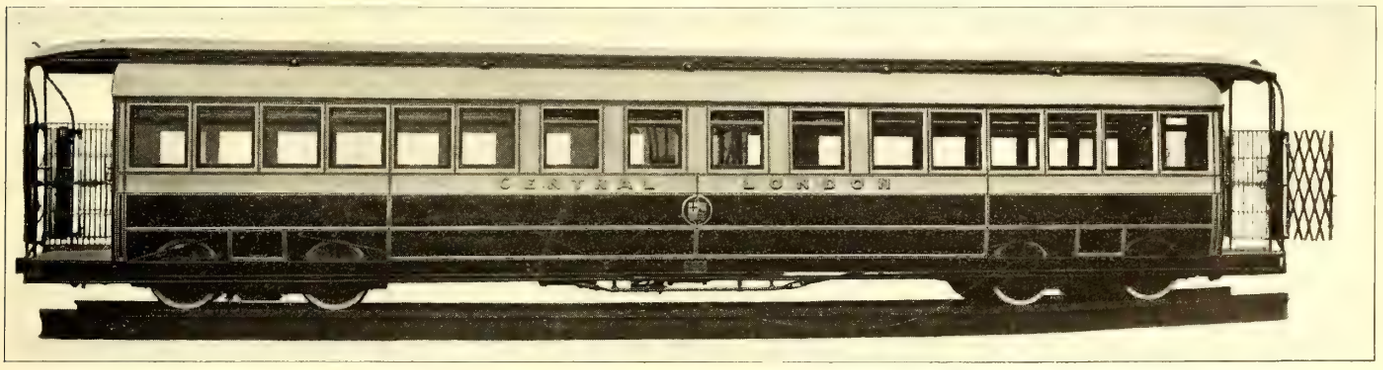
Central London Railway Car

Frequent reference has been made in the STREET RAILWAY JOURNAL to the Central London Underground Railway of London, and through the courtesy of the Brush Electrical Engineering Company, Ltd., of London, a view of one of the new cars, recently completed by this company for service on the Central London road, is given.

The main dimensions of these cars are:

Length over buffers	46 ft. 3 ins.
Length over headstocks	45 ft. 6 ins.
Length over body	39 ft. 0 ins.
Width over panels	8 ft. 6 ins.
Width at roof line	8 ft. 3 ins.
Height inside at middle	7 ft. 5 ins.
Center to center of bogies	29 ft. 6 ins.
Wheel base of bogies	5 ft. 0 ins.
Diameter of wheels on tread	2 ft. 5 ins.
Size of journals	6 ins. x 3 ins.
Center to center of journals	6 ft. 0 ins.
Gage	4 ft. 8½ ins.
Seating capacity	48 passengers

The seats are arranged longitudinally at each end with suitable arm rests, and at the center there are four rows of cross seats; this arrangement is necessary to allow the wheels to swivel under the



CAR FOR CENTRAL LONDON UNDERGROUND RAILWAY

longitudinal seats, as the cars are to run with ample clearance in an 11-ft. 6-in. tunnel, with the rails laid at a height of 1 ft. 7½ ins. from the invert of the tunnel. The seats and backs are provided with Wood's woven wire frames and upholstered in blue and crimson moquette velvet. The inside of carriage is paneled on the sides and ends with best white sycamore veneer; the panel framings are of light colored teak with teak moldings to match. The roof is arranged in three panels longitudinally and are covered with millboard ¼ in. thick, each panel having an ornamental lincrusta border carried along the sides and ends. Hand straps for the use of passengers are secured to a teak rail running the whole length of the carriage on the sides of the clere-story.

Brass baggage racks made of expanded metal, as well as hat and coat hooks, are provided along each side of the car. The whole neatly finished and lacquered. Ample ventilation is secured by means of hit-and-miss ventilators fitted to the sides of the clere-story, and hinged ventilators directly over the windows. In

addition ten "torpedo" air extractors (five along each side of roof) are used.

The roof is supported by channel steel carlines, and further strengthened at the center by two T steel arch bars, carried across the roof and down the sides of each cant rail. These carlines are covered with ornamental teak facings.

The whole of the body framing is made of well seasoned teak,

DUPLEX CAR FOR SOUDERTOWN

the side framing is trussed with diagonal braces, strap bolts and vertical tie rods.

The whole of the underframe is of rolled steel channel section, firmly bound together with knees and gusset plates.

The truck frames are of pressed steel made by the Leeds Forge Company. The truck centers are of cast steel with ample wearing surface and are mounted on spring bolsters also of pressed steel.

The axles are of best Siemens-Martin steel with wheel seats 4 ins. in diameter. The tires are 4½ ins. wide x 2 ins. thick and of Siemens-Martin steel. The wheels have wrought-iron bosses with teak centers and have Mansell's retaining rings. The wheels are forced on to the axles by hydraulic pressure of not less than 50 tons, without keys.

The cars are arranged with platforms at each end 3 ft. 3 ins. long with Gold's American automatic locking gates on each side of platform. The platform is further protected by iron screens 4 ft. 6 ins. high, with cross-over protected by chains. As a further safeguard a collapsible gate is fitted at opposite corners of each car, preventing passengers getting between the cars.

Each end of each car has a special arrangement of draw and buffer gear with India rubber springs and steel recoil springs. The whole of the drawgear is of best Yorkshire iron.

The cars are fitted with the Westinghouse quick acting brake with brake rigging of best hammered scrap, and all joints and pins properly case hardened.

Each car is fitted with ten electric lamps on two circuits, eight being inside and one at either end over the gangway, with junction boxes and flexible couplings between each car. Two oil lamps are fitted over each door for use in case of emergency.

The outside of the carriage is painted similar to the London & Northwestern Railway Company's stock. The body below the waist panels is painted purple lake, the waist panels and upwards are painted white and the moldings are painted purple lake throughout, with gold lines along the edges.

The end coaches of each train are arranged as smokers. They are upholstered in maroon haircloth and are provided with special drawgear for attaching to the electric locomotive.

Foundations have just been completed by the United Railways & Electric Company, of Baltimore, Md., for some very extensive repair shops in that city.

Duplex Car for Soudertown, Pa.

The accompanying engraving shows a combination open and closed car of the Duplex type, made by the Duplex Car Company for the Inland Traction Company, of Soudertown, Pa. The car is one of several of the same type built for this road, and is shown as an open car. The panels, of course, are slid up into the roof and can be dropped down within a very few minutes, and thus convert the car to closed car if desired. This feature of the ability to change the car quickly from open to closed and vice versa is one upon which the manufacturers of the car lay a great deal of stress. They claim that where the panels are detached from the car and stored during the summer, the main advantages of a duplex car is lost, as there are many times during the summer, as well as during the spring and fall months, when a quick change is desired, and if the panels are stored and have to be brought out and attached to the car to convert it, the delay in doing this will be so great as to lose the advantage in making the change. Again, when parts of this kind are stored, the chances of detioration are certainly as great, if not greater, than when they are carried on the car always ready for use.

The company reports doing an excellent business, and has recently been receiving orders for cars of the same type as that shown in the engraving from roads in Bellows Falls, Vt; Nelson, British Columbia; Lincoln, Neb.; Gardiner, Mass.; Allentown, Pa.; Buffalo, N. Y.; Schnectady, N. Y.; Bordentown, N. J.; Wilmington, Del., and elsewhere, as well as from roads abroad.

A Massachusetts Suburban Car

The accompanying engraving shows a type of car which has proved quite popular upon a number or roads in Eastern Massachusetts. The car shown is one built by the Laconia Car Company for the Blue Hill Street Railway, but the same car is used on the Brockton & Plymouth Street Railway and others.

CLOSED CAR FOR BLUE HILL

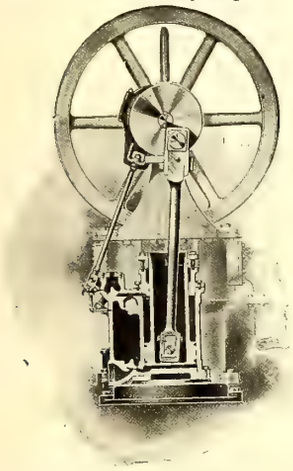
The car measures 40 ft. over all and has straight sides sheathed like steam railroad cars. There are ten double sash windows on each side, both sash being arranged to drop flush with the window sill. As the window sill is only 27 ins. above the floor, this makes practically a summer and winter car. There are ten reversible seats on each side, upholstered in rattan. The interior of the car is finished in quartered oak. The cars are furnished with the Laconia double trucks and Christensen air brakes.

Combined Air and Circulating Pump

The accompanying illustration shows a new combined air and circulating pump, recently brought out by the Conover Manufacturing Company, of New York.

The demand for economical results in modern power plants is rapidly extending to all parts of the equipment. Too little attention has been paid to the auxiliaries, and wide awake owners are no longer content to have only the main engines of the most efficient design, but insist on equal economy throughout. None of the parts of a modern plant is more important than the condensing apparatus, and especially in a surface condensing arrangement it is essential that the air and circulating pumps be of the most economical design in order to get efficient results. The air and circulating pump illustrated is very heavy in design, and being operated by a compound Corliss condensing engine the economy naturally is of a high order.

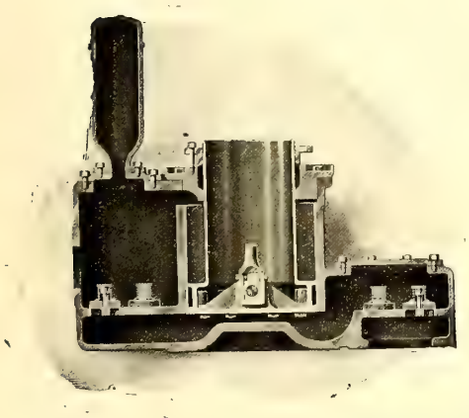
This engine is the same as used on the Conover jet condenser, which has proved its efficiency by years of use in the numerous large plants both here and abroad. The air pump is the regular Conover pattern, vertical, single-acting, and is made amply large for the slowest revolutions required to give the proper amount of water through the circulating pump. The pumps are arranged to vary the speed to give the proper amount of circulating water through the surface condenser at all times, the air pump taking care of itself. The air pump, excepting for the slight difference in friction, requires practically the same power to operate it without reference to the speed. As the same water and air are delivered in each case, a faster speed merely delivers a smaller quantity at each stroke, and proportionately reduces the mean effective pressure. This arrangement, therefore, gives all the advantages of separate air and circulating pumps in a combined machine, with less work to look after them and a much higher grade of economy.



CROSS SECTION OF ENGINE

The circulating pump is of the double acting, trunk displacement type, which gives a very steady discharge, and only requires one set of suction and discharge valves.

A cross section of the engine is shown. It will be seen on examination that this engine is compound condensing in one cylinder, and only takes steam once for a full revolution.



COMBINED AIR AND CIRCULATING PUMP

Long Cars for Rochester

The Jackson & Sharp Company, of Wilmington, Del., has just completed a number of long suburban cars for the Rochester & Sodus Bay Railroad, of Rochester, N. Y. The cars are illustrated herewith. The passenger cars, six in number, are 35 ft. long in frame, and 44 ft. 6 ins. over all. They are fitted with vestibules and side folding doors at each end. The interior finish is of quartered oak, in neat design, with carved mouldings, etc. They also have basket racks like those used in steam cars. In one end of the car a smoking room is provided. This room is more on the style of the smoking compartments in Pullman cars than anything yet attempted in cars for electric service. The distance of three win-

INTERIOR OF CAR

PASSENGER CAR

CAR WITH LARGE BAGGAGE COMPARTMENT

dows at one end is appropriated for this smoking compartment, and the entrance is from the platform.

At the end of the car are placed two hinged doors, one leading into the car proper through a passage way along the side of the car, and the other into the smoking room, which is provided with side slat seats, having seating capacity for eight to ten passengers. This room is also fitted with basket racks as well as coat and hat hooks.

CAR WITH SHORT BAGGAGE COMPARTMENT

The passenger end of the car is fitted with cross seats, upholstered in rattan. The windows are fitted with Pantasote curtains, made by the McKay Curtain Company, and fitted with patented fixtures. The car has seating capacity for forty-five passengers.

Owing to the large amount of country produce and baggage carried by this road, it has also ordered from the Jackson & Sharp Company eight combination passenger and baggage cars, as shown in the engraving above. These cars are like the passenger cars described above, except that 10 ft. of the space is appropriated for the baggage compartment, leaving 25 ft. for passenger service. The seating capacity of the passenger compartment is thirty-six, besides room for smokers in the baggage room, where folding seats are provided.

Four cars like those illustrated in the third engraving were also built for this road. These cars are also 35 ft. in frame and 44 ft. 6 ins. over all. Only 10 ft. of this space is appropriated for passenger service, and the balance, or 25 ft., is used for freight, produce, etc. The Jackson & Sharp Company is also building ten fifteen-bench open car bodies for the Rochester & Suburban Road.

The Wastefulness of Chimney Draft

In a recent editorial discussion of the question of the various methods for the utilization of waste heat, the *Engineer* considers, among other features, the usual method of producing draft by the ascent of heated air in a chimney.

Taking the boiler as the wasteful member in a steam plant, its efficiency varies from 60 per cent in a bad boiler to 80 per cent in a very good one, these proportions of the heat produced by the combustion of the coal being realized in steam available for the engine in each case.

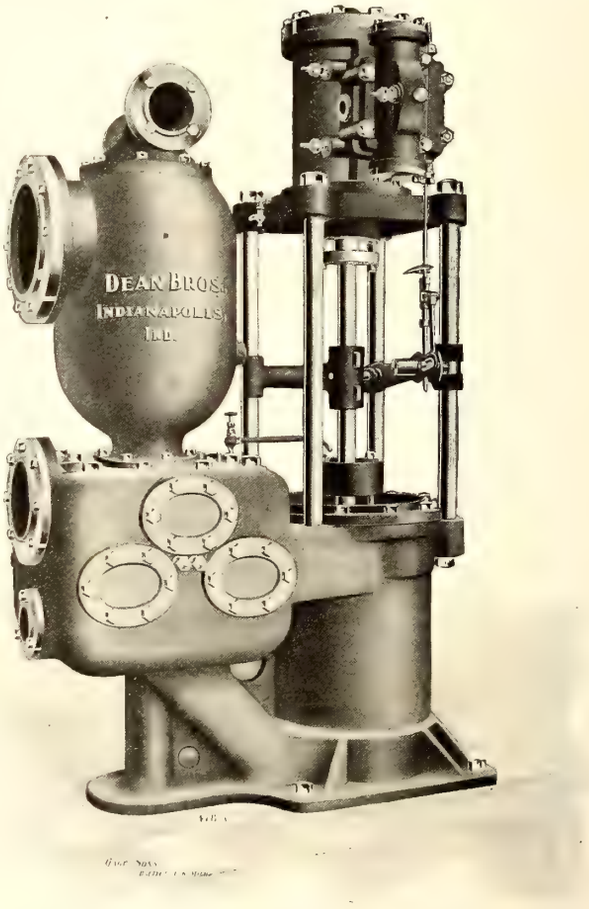
"The difference may be said, without greatly stretching the truth, to go up the chimney. It is not to be disputed that much of the waste heat might be caught and utilized, but there are reasons why it is not so caught. In the first place, the gases must be hot when they go into the chimney, or there will not be a draft.

"As a matter of fact, a draft got in this way is the most expensive possible, save one. The exception is a steam jet in the chimney. A fan can be run for about one-tenth of the power represented by the waste heat required to command a good draft. A tall chimney will cost from $5,000 to $25,000—very much more than will a fan plant. But the fan is not used and the chimney is, largely because it is essential to discharge the products of combustion high up in the air over the roofs of surrounding houses. This necessity must be taken into account in so far as factories are concerned, but it does not hold good of steamships; yet we believe that in most cases a chimney stack 100 ft. high would be sufficient, because with a fan, combustion could be more easily controlled than is possible with a chimney, to the end of preventing the giving off of smoke."

Vertical Double Acting Air Pump and Jet Condenser

It was formerly supposed that a vertical air pump must be single acting, but Dean Bros., of Indianapolis, have perfected a vertical air pump that is double acting, and is therefore double the capacity of a single acting air pump of the same dimensions. A view of this machine is given herewith. It is especially adapted to the requirements of high pressure, high speed engines, and is claimed to be more economical, more efficient, simpler and safer than than air pumps connected to the engine.

It is started before the engine, and the vacuum obtained is used to assist in the first revolutions. This feature is almost indispensable with triple expansion engines, as the full power of the low-pressure cylinder is secured at once. It adds nothing to the load of the engine, and takes less than half the power of a pump operated by the engine. The air pump is bronze lined, and has a bronze piston rod. There are no valves in the piston, all the valves being in the water chest at the side where they are quickly accessible. It is claimed to save 20 to 30 per cent of the steam used by the engine, and can be operated on one-half of 1 per cent of the steam consumed by the engine. It is manufactured by Dean Bros. Steam Pump Works, Indianapolis, Ind.



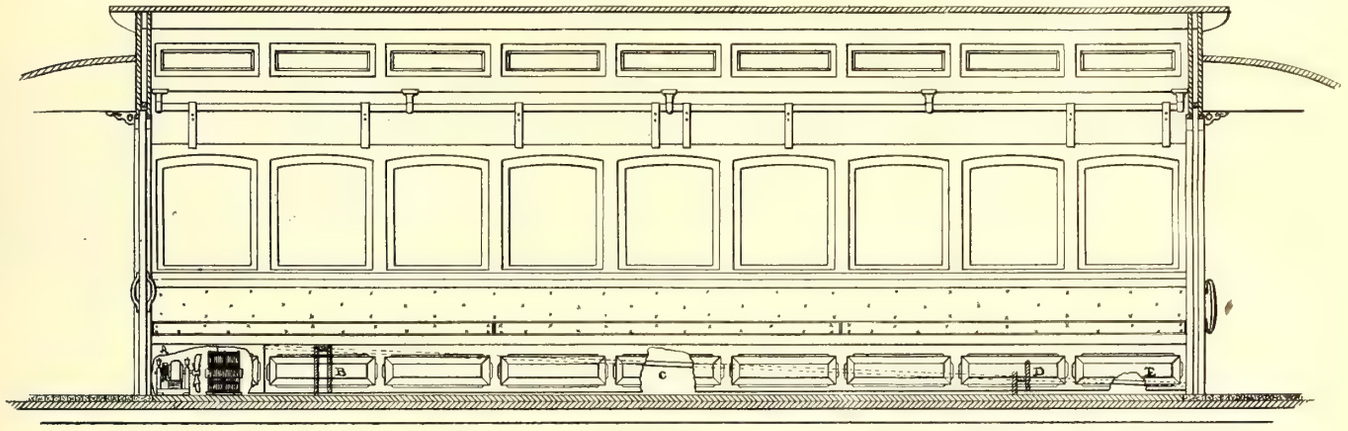
VERTICAL AIR PUMP AND JET CONDENSER

The Société Générale des Tramways Electriques en Espagne, which was formed last year in Madrid, Spain, with a capital of f.10,000,000, is about to increase its capital to f.20,000,000 for the purpose of building new electric tramways in various parts of the country. This company controls all the tramway lines in Madrid, most of which are still run by horse power. This increase of capital is for the sole purpose of converting the entire horse car system into electric traction.

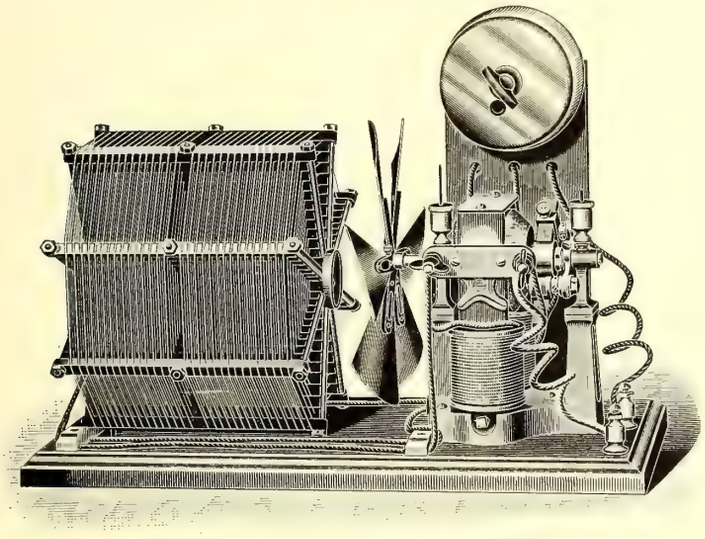
An Improved Electric Car Heater

The problem of sanitation and economy in the heating of electric cars is one requiring much consideration. A heater that makes use of every heat unit employed, keeps the air in circulation, and uses only pure air from the outside of the car would seem to be most desirable. The cuts accompanying this article illustrate a system which is claimed to fulfill these conditions without its being difficult to install or encroaching upon the passenger space of the car.

The heater consists of a heating web woven with special resistance wire, by means of which the heat is generated. One heater is sufficient for an electric car with an inside length of 25 ft., but two may be employed if considered an advantage for any particular reason. Behind the heating web is placed a fan motor of special construction, which, with an ingenious arrangement for forcing the air equally to all parts of the car completes the entire heating apparatus. The heating web and motor are enclosed in a case, which can be removed at will from the car, or they may be permanently located in the car. In either case they occupy but small space, and can be placed under the seat at the end of the car, or under the floor of the car itself. The heat issues at the floor, and at all parts equally, thus heating a part of the car not affected by a stationary heater. In connection with the heater a special switch is used, constructed so as to admit of the regulation of the heat. The accompanying illustration gives an idea of the heater and motor as they appear before being enclosed. In operation, no parts whatever are visible to the occupant of the car, and it is claimed that no parts can be over-heated.



SECTION OF CAR, SHOWING HEATER



ELECTRIC FAN AND HEATING WEB

The fresh air from the outside is heated directly, and, by means of the fan, is forced into the car, thus putting the entire body of air in circulation, the heat being evenly distributed.

The manner in which the air enters the interior is shown in the section given of a car equipped with this apparatus. The riser under the seat does not quite reach the floor, thus leaving a narrow slit the entire length of the seat for the admission into the car of the heated air. A longitudinal partition gradually diminishes the size of the air chamber under the seat, so that although the pressure falls off as we recede from the fan, an even flow throughout the entire length of the slit is secured. In the drawing this partition may be seen where the panel is cut away at *C*, the dotted line showing how it slopes from one end to the other.

It is claimed that this system has many advantages over the stationary heaters commonly used. Among them may be mentioned the impossibility of over-heating the woodwork, cushions, etc., and the greater rapidity with which a car can be heated. The heater itself does not rise to a very high temperature, as the continual current of air being warmed prevents its retaining the heat. No metal whatever, appears on the surface of the car riser, or at any point where it could be seen or felt by persons in the car.

The system above described is being brought out by Bay State Electric Heat & Light Company, of Boston, Mass., and is called the Bay State heater. The apparatus is being tested by some large companies, among them the Lynn & Boston Railroad Company, and it is claimed that the results bear out fully the theoretical prophecies.

The Spiral Nut-Lock

The novel nut-lock illustrated on this page is being brought to the attention of railway men throughout the country. S. A. Crone, formerly master car builder for the New York Central Railroad and a past president of the Master Car Builders' Association, has been made selling agent for the Spiral Nut-Lock Company, which is placing the device on the market, and he has succeeded in interesting many of the large roads in what he claims to be the simplest, cheapest and most effective nut-lock ever produced. Since its introduction less than a year ago numerous tests have been made on tracks, locomotives, steam drills and hammers, and other places where the vibration caused all formerly used locking devices to fail, and in every case the company reports satisfactory operation.

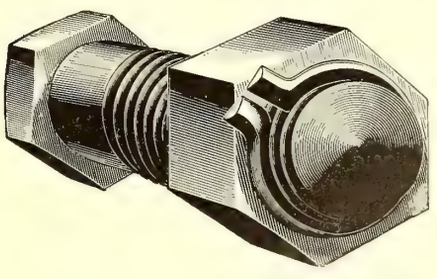


FIG. 1.—BOLT WITH NUT LOCK

FIG. 2.—NUT LOCK

The nut-lock is made of crucible steel triangular wire, bent cold and tempered. It is made a little smaller than the diameter of the bolt, but after it has been started on the end of the bolt any leverage applied betwen the projecting ends, such as a screwdriver or flat key, will spring the lock open enough to allow of its being easily screwed up against the nut. The curve of the spiral changes as shown in the cut, and in order that the entire circumference of the thread may be gripped effectively, the nut-lock must be put on "right side out." This is made very simple by having the end which is first to engage the thread flattened, as shown by the arrow in Fig. 2, so that the workmen can tell at a glance which way to apply it. The removal is as simple as placing it in position, and should it be rusted on a blow from a hammer will break it off. The

price is claimed to be lower than that of jam-nuts of the same size, and a shorter bolt can be used than would be necessary with any kind of split washer, jam-nut, etc.

Perhaps the reason for its tenacious grip on the thread of the bolt is due to the fact that the nut only touches the spiral for about one-third of its length, thus reducing the power which it would have to turn the nut-lock.

Opening of a New Electric Railway in Brazil

The first section of the electric tramway system of the Sao Paulo Electric Railway, Light & Power Company, Ltd., which was described in the STREET RAILWAY JOURNAL for July, 1899, was put in operation last May. As will be remembered, this line is being built by American engineers and American capital, and the construction of the road was carried on largely under the personal direction of F. S. Pearson, of New York, who is largely interested in the enterprise.

The daily papers published in Sao Paulo immediately after the opening of the first section of the line, have just arrived in this country, and announce the great interest taken in the electric cars, and the enthusiasm of the inhabitants over the inauguration of the

FIRST CAR ON BOM RETIRO LINE

electric system. The following account of the opening of the line is taken from one of the leading Sao Paulo papers.

"In the hurried lines of a notice which suffers from the haste with which it is written it is impossible to give the exact measure of the intensity of joy and satisfaction which was visible in the looks of all on account of the realization of so notable an improvement. The enthusiasm of the people crowding on the streets through which the vehicles ran is indescribable, and when the cars were placed at the orders of the public after the inauguration, one can hardly imagine the extent of the invasion that took place. Everybody made efforts to obtain seats in the cars, but in spite of the natural confusion of such occasions, not the slightest incident took place that might sound a discordant note in the great festival, in which the people took part with the highest demonstration of joy.

"Having given in the beginning this salient point, we will describe the inauguration of the great improvement according to the notes we were able to take.

"As had been arranged, several persons invited had repaired at 12 o'clock to the building in Rua Direita, where is the office of the Sao Paulo Railway, Light & Power Company, Ltd., and the store of James Mitchell & Company, to set out together from there to the company's power house, where the president of the State was to start the principal engine, while the other guests were at the car house at Alamedo Barae de Limeira, at 2 o'clock, the hour for the inauguration. At the company's power house at the Rue Monsenor Andrade, where the guests arrived at 1 p. m., there were Dr. Oliveira Ribeiro, chief of police, accompanied by his aide-de-camp, Captain Ozorio, and Dr. Cerqueira Cezar, president of the Senate, besides Dr. Campos Porto, representing the Platea, and Sr. Anibal Machado, of the Imperio, and other engineers of the company. Afterwards there arrrived Dr. Rodrigues Alves, president of the State, his aid-de-camp, Captain Jayme Marcondes, Dr. Prudente de Moraes, accompanied by his son, Antonio Prudente de Moraes.

"At twenty-five minutes past 1 Dr. Roiz Alves started the big engine by moving the throttle valve; a few moments afterward Drs. Roiz Alves, Prudente de Moraes, Domingos de Moraes, Bento Bueno, Francisco Malta, Cerqueira Cezar and Mrs. Burchard made the several connections of the current producing and safety apparatus, transmitting the electric energy to the cables and supplying light, which appeared in all the lamps of the building. After a short examination of all the machinery and the great boilers, the guests started for the car house at the Alameda Barao De Limeira, where they arrived at 2 o'clock.

"There were present Dr. Albuquerque Luis, president of the Camaraete, representatives of the prefecture, and many other deputies, senators, and a great host of persons, whose names it was impossible to take down. After a rapid visit to the storehouse, the guests took their places in the six cars, which were in front of the building. The cars were decorated with flags and festooned, the Brazilian, British and American flags being seen at the top.

OPENING OF LINE

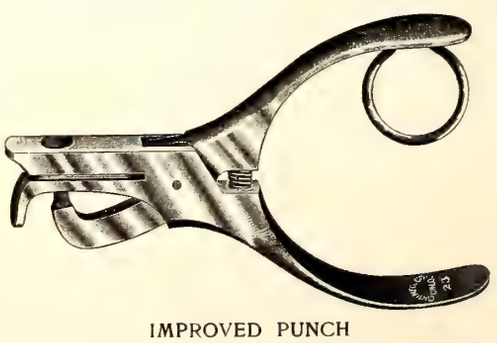
"At ten minutes past two, when the National, British and American hymns were being played, the cars started, making the inaugural trip along Alameda de Limeira, etc. Along the whole line the crowd of people was immense, greeting the electric company, and the windows were filled with families looking on. From Largo Sao Bento all the cars returned as far as the temporary terminal point at the end of the Alameda Barao de Limeira, where they again returned to the car house. There a profuse and liberal lunch was served, 200 persons sitting down at the table, the service being done by the Confeitaria Castelloes. During the lunch the band played several pieces.

"On serving the champagne Dr. Carlos de Campos arose, and in the name of the company greeted the President of the State and Municipal Prefect, as representing the people. Dr. Antonio Prado, referring to the great improvement, introduced in this capital, greeted the Electric Tramway Company. Mr. Brown, superintendent, returning thanks for the toast which had been proposed, drank to the prosperity of the State of Sao Paulo and the agrandisement of the Brazilian country.

"The toast of honor was proposed by Dr. Roiz Alves to Dr. Campos Salles, president of the Republic, this toast being enthusiastically responded to, the band of the police brigade playing the National Hymn. During the remainder of the afternoon the electric cars were offered gratuitously to the public, making several trips between Largo Sao Bento and Alameda Barao de Limeira, carrying a considerable number of passengers, many hanging on at the sides. At 7 p. m. the traffic was suspended, to begin today the regular trips."

An Improved Ticket Punch

The form of punch illustrated herewith is intended to be of service in all cases where a first-class article is desired. It has a long reach, thus facilitating its use on roads which have long transfer tickets, and the open sight permits the conductor to operate it



IMPROVED PUNCH

quickly and accurately. The dies are of hardened tempered steel, which gives good results after long wear. This punch is one of twenty-five styles made by the Cincinnati Manufacturing Company, Cincinnati, Ohio. The design is new, but wherever introduced has given satisfaction.

The New Plant of the Falk Company

Most readers of this paper will remember the announcement that appeared in the JOURNAL considerably over a year ago, stating that the works of the Falk Company, at Milwaukee had been completely destroyed by fire. The company immediately began the erection of a new plant, work upon which was retarded considerably by the difficulty in securing material. The new works are located in the Menominee Valley at the foot of Thirtieth Street, some twenty minutes' ride from the heart of the city. Beside the office building, there are three large separate buildings, the foundry, machine shops, blacksmith shop and power house.

The office is a model of convenience, comfort and elegance; the entire interior being built of hard wood, and furnished throughout, desks, chairs, tables, etc., etc., of golden oak. It is equipped with a fire proof vault, toilet and wash rooms, a shower bath, private rooms for the various members of the company, and a directors' room.

The first building next the office is the open hearth steel foundry. It is of steel and brick, the same construction being used for all the buildings. The foundry is 100 ft. x 200 ft., one end being boarded up temporarily, allowing for extension at any time. The foundry is equipped in every department with the most modern apparatus, including a Wellman-Seaver tilting furnace, which has many advantages over the old style of stationary furnaces. Steel is made by what is known as the acid process, which produces castings which are perfect as regards finish, free from blow holes and other defects. Two, 25-ton with 5-ton auxiliary hoist, each, Pawling & Harnischfeger cranes are in use. The foundry has a capacity of about 50 tons per day, and is equipped to handle castings from 30 lbs. to 35,000 lbs. each. The cleaning apparatus is of the most improved kind, and designed by members of the company. The Falk Company takes particular pride in its ability to turn out castings which have troubled other founders, and has already gained an enviable reputation for this class of work. The company makes all its own gear castings, of which it is a large manufacturer. This gives the advantage of being able to secure uniform material and that best suited to this particular line of work. These gears are all made with specially constructed flasks, as well as other apparatus; the methods employed are such as to produce castings absolutely free from blow holes and true to pattern. Since the foundry was started not a single casting has been discarded on account of developing blow holes, which indicates the uniform quality of the Falk gears.

A specialty is also made of castings for steam railways, castings for engine and cars, and knuckles for coupler repairs, the latter being produced by the thousands.

All iron and steel used in the various departments is analyzed in the company's own laboratory, fitted up in one corner of the foundry. This is all bought on a specified analysis, and if any is not found strictly up to specifications it is rejected. A competent chemist devotes his entire time to this work.

The machine shop is also 100 ft. x 200 ft. It has every modern appliance for the manufacture of gears and pinions and special work. All machines are driven by motors, either directly connected or bolted, so that one motor drives a group of two to four machines. The latter ones are placed on an overhead platform, running the entire length of the shop. All are driven from a generator in the power house. An interesting corner under this roof is that of the inspection department. Here every gear and pinion passes a rigid test for errors in dimension or flaws in material, with the result that the Falk Company has no shipments returned from dissatisfied customers.

VIEWS IN THE WORKS OF THE FALK CO.

Back of the machine shop is a large platform for laying out special work; here also are the sand and stock sheds and pattern building. Beyond the machine shop is the building containing the blacksmith shop and power station. Here are made all pinion forgings, used by the company; these are made from open hearth steel billets, of high carbon, which is found to be the very best grade of material suitable for this work. The pinions are made from individual forgings, which are hammered thoroughly to produce a very close grain and hard metal.

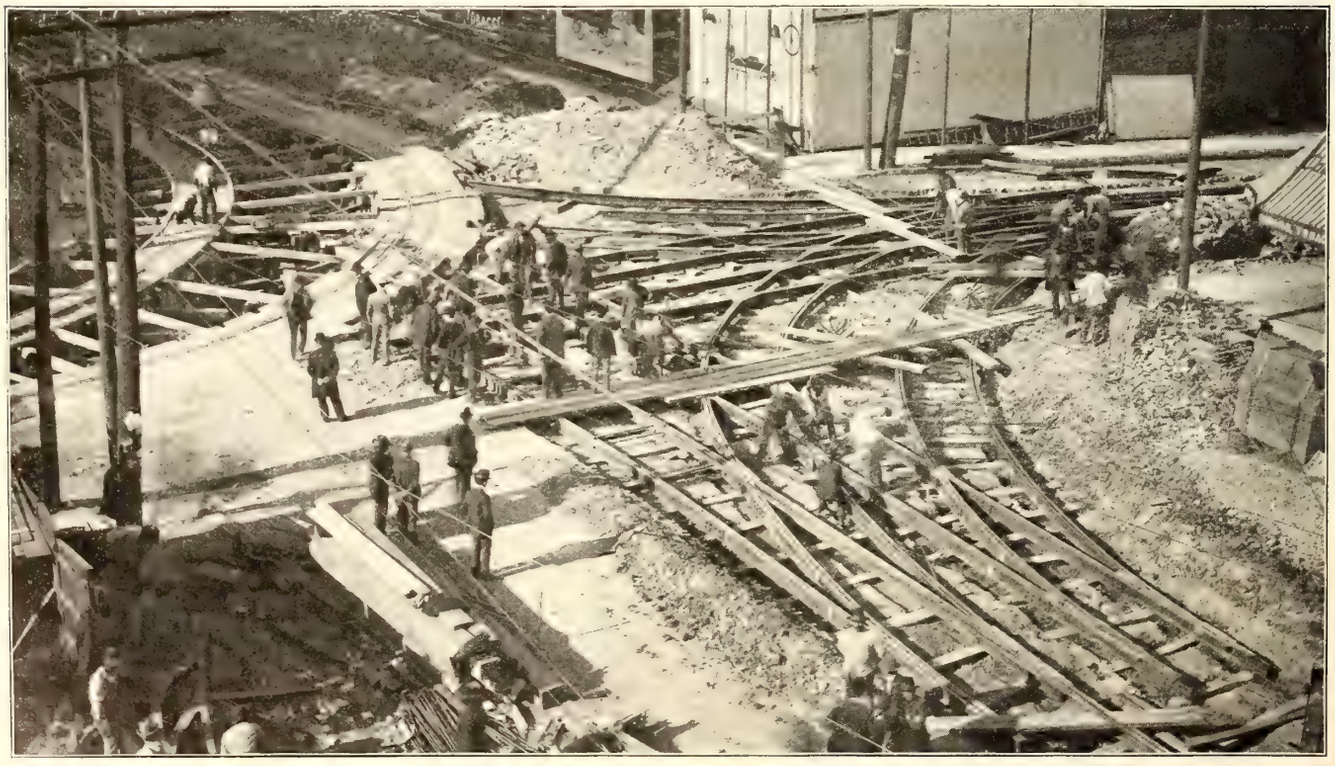
The engine room, in one end of this building, has a 250-hp horizontal Allis Corliss engine, belted to a 220-volt 150-kw. General Electric generator. The switch board has Cutter circuit breakers, and Weston instruments. The boiler plant consists of three 80-hp tubular boilers. The shops are heated with hot air.

The factory's railroad facilities could hardly be improved upon, as switches from the C. M. & St. P. R. R. run through each shop building, and bring material to the yard outside.

The Falk Company was organized in 1894, under the name of The Falk Manufacturing Company, and introduced upon the market the cast-welded rail joint, upon which the company owns all the original letters-patent, and which it is at present vigorously defending against all infringers. When this joint was first brought out, it was accepted with a great deal of hesitancy by street railway men and engineers, but actual practice has long since demonstrated its success, and it is now standard construction on all roads throughout the world. The Falk Company has welded nearly 1,000,000 joints.

At the suggestion of railway men, for whom the company was already doing work, the manufacture of special work was taken up, and this department has grown until the Falk Company is now

CONSTRUCTION WORK AT KANSAS CITY



COMPLICATED CURVE AT KANSAS CITY

one of the largest special work manufacturers in the country.

In commencing the manufacture of special work, the company secured the services of a competent corps of engineers, and began the construction and complete equipment of electric street railways. The company has an excellent organization for this class of work, and takes a great deal of pleasure in pointing to such work as that done for the Citizens' Traction Company, Oshkosh, Wis.; the building of the Interurban Railway between Oshkosh and Neenah, Wis.; the reconstruction of the lines at Davenport, Ia., Decatur, Ill., and Kansas City, Mo. Of this latter work, upon which the company has been employed for the last two seasons, it is especially proud. Here the company has recently accomplished one of the most difficult engineering feats met with in street railway construction. The problem was to change the double cable track on Grand Avenue between Eighth and Ninth Streets, which was one compound curve, extending the entire block, to simple curves at Eighth and Ninth Street corners with straight track connecting. This necessitated moving both tracks bodily, several feet to one side of the old location. The operation shortened the track to the extent that the cable itself had to be shortened twice during the progress of the work. The headway between trains at this point does not exceed two or three minutes, which made the work extremely difficult and dangerous. Thus far there has not been the slightest obstruction to traffic, nor a single accident, and the work is practically finished, notwithstanding the fact that the feat was considered by even the street railway company itself, as practically impossible.

Considering the short time it has been in existence the Falk Company has had a remarkable growth. This is due to the honesty of its work and products, coupled with courteous treatment towards all of its customers, who can be found in almost every street railway town, not only in America, but of Europe as well. Its foreign shipments number many tons of material a month, and its cast-welding outfits can be found in many places on the continent.

The officers of the company are Herman W. Falk, president; Otto H. Falk, vice-president; E. A. Wurster, secretary and treasurer; Clement C. Smith, second vice-president; Adolph Quentin, third vice-president; C. L. Jones, assistant secretary; W. Frank Carr, chief engineer.

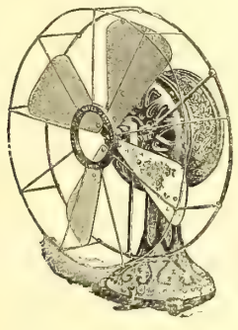
WORKS OF THE FALK CO.

Electric Fans

As the summer is approaching the question of motor fans becomes again of importance, and that this is of interest to electric railway companies as well as to companies distributing electric power for miscellaneous purposes is shown by the fact that a number of fan manufacturers build fans for 500-volt circuits. The desk fan illustrated herewith is from the factory of D. L. Bates & Brother, located at Dayton, Ohio. This concern is not new in the business, having been engaged in the manufacture of electric fans for the last nine years, and it reports an increasing demand for its product. While the types of fans are somewhat familiar, various improvements have been made both in mechanical construction and in the efficiency of the motors. The fans are finished in nickel, oxidized copper, polished brass and Japan.

Freight Car on Maximum-Traction Trucks

The accompanying illustration represents a novelty which may be of interest to street railway men and others. It is nothing less than a 30-ft. freight car, mounted on maximum traction trucks. It was built by the J. G. Brill Company for the Winston Road in North Carolina. At one end are four posts which carry the trolley pole. Both ends are fitted with dashers and brake wheels. The car is of the regular steam gondola type, with truss rods and needle beams, stake pockets and stakes running along the sides. The body was made as low as practicable, and is 7 ft., 6 ins. wide at the sills. There are two G. E. 58 motors. The trucks have a 4-ft. wheel base, the wheels being 33 ins. in diameter, with 3-in. tread and 5/8-in. flange. The gage is standard.



ELECTRIC FAN

ELECTRIC FREIGHT CAR

CURRENT NEWS

Syracuse Mutual Benefit Association

The Mutual Benefit Association of the Syracuse Rapid Transit Company, is one of the strongest organizations of its kind in the country, and has a membership of 250, out of about 350 employees. A large number of those who are not members now are ineligible on account of age. The organization has rooms fitted up in the Gridley Block, and they occupy nearly the entire top floor. The association is a combined pleasure and benefit organization, and pays $1 a day during a member's sickness, and $150 when a member dies. The rooms of the company are laid out after the style of other similar organizations, and are supplied with billiard tables, etc., for the amusement of members. On May 14 the membership was increased by the initiation of about 100 new members. On this occasion the board of trustees served a repast, and an enjoyable evening was spent. From present indications the association will soon have a very handsome reserve fund.

Bridgeport Traction Company's Employees' Association

The employees of the Bridgeport Traction Company organized the Bridgeport Traction Company's Employees' Association on June 22. The organization has a membership of 50, and it is expected that this will be increased to 150. The new organization is planned after, and will follow the lines of the Mutual Benefit Association, of the Syracuse Rapid Transit Company. It will pay both sick and death benefits, and will shortly fit up club rooms where members will be entertained. The officers of the organization are: President, Thomas Burke; vice-president, William Killeen; financial secretary, Robert McCullough; recording secretary, Edward McCormack; treasurer, Howard Miller. A committee on by-laws was appointed as follows: Harry Daunt, chairman; Frank Riley, John Lynch, Henry Bain and Charles Neadles.

New Air Cars in New York

The Metropolitan Street Railway Company has just received from the Compressed Air Company the first of the perfected type of air motors intended for service on its Twenty-eighth and Twenty-ninth Street crosstown lines. The present old style air motors will be withdrawn from service on Twenty-eighth and Twenty-ninth Streets, and horse cars temporarily substituted so that the present car bodies can be fitted with the improved type of air motors. Meanwhile the line is being relaid with heavy steel rails. The new motors are the first of the 125 motors the Compressed Air Company is under contract to build for the Metropolitan. The motors are of improved and perfected design, obviating objectionable features and of increased power and economy.

Transfers in Baltimore

The United Railways & Electric Company, of Baltimore, Md., will, after July 1, give transfers on all its lines. Some time ago the transfer system was partly abolished on account of the abuse it received from the traveling public, but it is thought that under the new system the passengers and railway company will both be satisfied. Transfers will be given at all points of intersection except those points at which the passenger could take a car returning in the same general direction from which he had come or those which mark the terminus of one of the various lines.

Suits Against the Chicago Elevated Railroads

James R. Walker and the executors of the will of W. D. Walker have begun suit in the Superior Court against the Union Elevated Railroad Company for $250,000, and against the Union Consolidated Railway Company and the Union Elevated Railroad Company for $150,000, as damages. L. Z. Leiter is plaintiff in a suit against the Union Elevated Railroad Company and the Union Consolidated Elevated Railway Company for $1,000,000, and in one against the Union Elevated Railroad Company and the Northwestern Railroad Company for $100,000 as damages. The Union Elevated Railroad Company is also made defendant in suits begun by Thomas Murdock and Byron L. Smith and Ezra J. Warner, trustees under the will of Simon Reid, who asks damages in the sum of $150,000. The damage to the property is caused, it is alleged, by the construction and operation of the roads in the vicinity of the buildings owned by the plaintiffs. The plaintiffs and the amount of damages sought in still other suits are James Oliver for $150,000, against the Union Elevated and the Union Consolidated Railroad companies, and William C. Lebenstine, for $250,000 and $50,000, against the Union Elevated and the Northwestern Elevated Railroad companies.

Organization of Employees' Club at Camden

On Monday evening, June 11, an interesting gathering of the employees of the Camden & Suburban Railway Company of Camden, N. J., was held at the new car house, Newton Avenue, near City Hall, at which time a room was presented by the management of the company for the use of the employees as a recreation and reading room. The room has been provided with conveniences, nicely furnished with chairs, tables, black board and hat racks. A large number of popular magazines and technical journals have been subscribed for. The room was presented by Walter E. Harrington, general manager, and accepted on behalf of the employees by Samuel Holmes, one of the company's oldest employees. In presenting the room and describing among several of the purposes for which the room would be used, the following novel plan was proposed: To set aside one night in each month to be called "discussion night," at which time a subject would be selected of interest to the employees, relating to some subject in connection with the operation of the road; a committee chosen among the men to investigate, test and otherwise make an elaborate report to be read at the following meeting, and to be open for discussion by the employees and others interested; the full proceedings of the meeting to be taken stenographically and edited, in order to be kept on file. In connection with the above the social side is to be provided for. The employees voted a resolution of thanks, to be presented to the company, and a committee was appointed by the employees, of which B. Bibighaus was chairman.

The subject of "brakes" has been selected for the next meeting night of the club, and a committee of five motormen has been delegated to make tests and determine the time and distance it will take to stop cars of different weights and sizes. The subject for the evening in August is "How to Handle Controllers."

It is the intention of the club to cover, not only matters of electrical interests, but also general operating problems. The employees have taken an enthusiastic interest in this plan, and the committee appointed to investigate brakes has already had a meeting.

PERSONAL MENTION

MR. W. D. SARGENT, general manager of the Sargent Company, Chicago, returned from Europe Saturday last, the 23d, after a two months' trip.

MR. CHARLES P. TOLMAN, of the Christensen Engineering Company, of New York, is in Manchester, N. H., superintending the work of equipping the large cars of the Manchester Street Railway, with air brakes.

MR. CHARLES A. WORTS, of Oswego, has been elected general manager of the Rome Street Railway Company, of Rome, N. Y., to succeed Mr. W. P. Brown, who resigned to accept a position as general manager of a steam railroad.

MR. PETER KLING has resigned his position as general manager of the St. Louis Car Company, to accept a similar position with the John Stephenson Company in New York. It is not known who will succeed Mr. Kling, as Mr. Kobusch, president of the company, is out of the city.

MR. ALEX. WILSON, who recently left the employ of the Hamilton, Grimsby & Beamsville Railway to become chief clerk of the Hamilton Street Railway Company, of Hamilton, Ont., was presented with a gold mounted silk umbrella, suitably inscribed, in recognition of the company's appreciation of his six years of faithful service on the Hamilton, Grimsby & Beamsville Electric Railway. The presentation took place in the company's office, Vice-President W. J. Harris making the presentation speech.

MR. GORDON ABBOTT has been elected to fill the vacancy caused by the death of Mr. Amos Breed, as president of the Massachusetts Electric Companies. Mr. Abbott is also president of the Tacoma Railway & Light Company, of Tacoma, Wash.

MR. S. W. CHILDS, of the J. G. White Company, of New York, has just returned from Perth, Australia, where he has been for the past eighteen months superintending the electrical equipment of the Perth Tramways. Mr. Childs made a host of friends during his stay in Australia, and was given a rousing reception previous to his return home. A farewell banquet was tendered in his honor at the Grosvenor Hotel, and it was attended by the merchants of the city, councillors and officers of the city, and contractors and employees of the Electric Tramways Company. During the toast, "The Guest of the Evening," Mr. Childs was highly complimented for his good work, and regret was expressed at his retirement from the service. Mr. Childs was the recipient of two purses of sovereigns, one from the merchants, contractors and officers of the Council, and one from the employees of the Tramway Company. Mr. H. J. Somerset succeeds Mr. Childs.

NEWS NOTES

MIDDLETOWN, CONN.—The offices of the Middletown Street Railway Company were entered by burglars recently. It is not known how much the robbers secured.

BRIDGEPORT, CONN.—The Bridgeport Traction Company intends to inaugurate an express service on its line between Bridgeport and Woodmont.

HARTFORD, CONN.—The Hartford Street Railway Company has presented the Common Council with a petition for several extensions of its system. It is proposed to run a single track from the Barnard Park on Main Street through Park Street to Lafayette Street, and to lay a single track from Zion Street to Laurel, thus making a through track from Main Street through Park Street to Prospect Avenue. Another line of single track is to run from Main Street through Capen Street to its junction with Barbour Street and thence to Keney Park. Another extension is a double track from Barnard Park south through Maple and Franklin Avenues to the Wethersfield town line.

CHICAGO, ILL.—Charles L. Bonney, as counsel of the Chicago General Railway Company, has submitted to the reorganization committee a plan for the proposed reorganization of the road. He says that by continuing the receivership for about a year the assets of the company can be collected, the floating debt paid and the property returned to its stockholders.

CHICAGO, ILL.—Through the kindness of President Roach, of Chicago, the Union Traction Company, who donated the use of two electric cars, 150 women and children of St. Elizabeth's Social Settlement were given an outing from the settlement house, June 22.

CHICAGO, ILL.—Lawton C. Bonney, shareholder of the Chicago General Railway Company, has brought suit for $125,000 damages against John A. King and John H. Witbeck. The latter was for a time president of the company. The suit is based on the allegation that the defendants conspired together to injure the credit and business of the plaintiff. During May suits on notes for an aggregate of $125,000 were brought against the Bonneys, Lawton C. and Charles L. Bonney, by John H. Witbeck. These actions were on notes signed by the Bonneys, which Witbeck declared were due to him. L. C. Bonney asserts the notes had been paid by Witbeck with funds from the assets of the company. John A. King, co-defendant with Mr. Witbeck, is president of the Fort Dearborn National Bank.

NEW ORLEANS, LA.—The lower branch of the Louisiana Legislature passed an act June 26 to compel separate and equal accommodations for blacks and whites on street car lines. It is believed that the Senate will pass the measure.

BOSTON, MASS.—On June 28 Governor Crane signed the bill to compel street railway companies to vestibule their cars.

AMHERST, MASS.—Electric and steam railway interests are in conflict here. The Boston & Maine Railroad has applied for an injunction to prevent the Amherst & Sunderland Street Railway Company from continuing to cross a bridge over the Boston & Maine here.

BOSTON, MASS.—It is expected that the overhead division of the Boston Elevated Railway Company will be in operation by Jan. 1, 1901. But for delays in receiving deliveries of materials on contract the division would have been in operation Oct. 1.

RUTHERFORD, N. J.—W. C. Giles, president of the Newark & Hackensack Traction Company, swore out a warrant for the arrest of Captain Addison Ely, president of the Bergen County *Herald* Publishing Company, and Henry H. Copeland and Edward J. Luce, of the law firm of Copeland, Luce & Kipp, on June 20, on a charge of conspiring to publish a libel against the Traction Company. The libel complained of was published in the Bergen County *Herald*, and Mr. Giles already has suits pending against Captain Ely and the newspaper, in which he asks damages of $50,000.

NEWARK, N. J.—The North Jersey Street Railway Company has adopted an ingenious device to save the passengers in its open cars from the consequences of poking their heads out of the car where they are likely to get in the way of any vehicle on the other track. On the side of the cars facing the opposite track the company is putting in, above the side-bar and on a level with the passengers' heads, a light wire grating about 18 ins. wide. To get his head outside of this a passenger must either lie down on the floor and crawl underneath the grating or stand on the seat and lean out near the roof. The screen is transferable to either side.

ROCHESTER, N. Y.—The employees of the Rochester Railway Company held their first annual outing on June 25, at the Island Cottage, Buck Pond, on the Manitou Beach Railway. It is estimated that 200 employees were able to be at the picnic. Athletic sports were indulged in, and a game of baseball was played. A number of officials of the company were at the picnic. Among them were Treasurer Moorehouse, General Manager Nicholl and Superintendent Hicks.

SYRACUSE, N. Y.—The Syracuse Rapid Transit Company proposes to equip its cars with illuminated destination signs in the near future.

NEW YORK, N. Y.—The proposed hearing on the application of the Metropolitan Street Railway Company for a street-car franchise in Elm Street, before a joint committee of the Municipal Assembly, has been postponed indefinitely.

BROOKLYN, N. Y.—Two young women were struck by a car of the Brooklyn Rapid Transit Company on the Coney Island Creek Bridge at 1:30 o'clock on June 21 and instantly killed.

NEW YORK, N. Y.—Justice Bischoff, in the Supreme Court, by consent of the lawyers, adjourned until July 9 the arguments on the application of the Manhattan Railway Company to continue the injunction to restrain the Park Board from interfering with its elevated structure in Battery Park.

SYRACUSE, N. Y.—Attorney-General Davies has reserved decision after listening to arguments on an application of Samuel Ferguson for the beginning of an action to annul the franchises of the Syracuse & Oneida Lake Electric Railway Company, made on the grounds that it has failed to construct its road within a year after having obtained the required consent from the authorities of the towns through which it proposes to pass.

UTICA, N. Y.—The Utica Belt Line Street Railroad Company has voluntarily increased the wages of its employees. The following bulletin, posted on the bulletin board at the depot June 25, announcing the change: "Utica, June 25.—Commencing July 1, 1900, conductors and motormen during the first year of their employment will receive 14 cents an hour; between one and five years, 15 cents an hour, and over five years 16 cents an hour. Conductors and motormen who shall have been continuously in the employ of the company for five years will be entitled to wear two service stripes on the left coat sleeve of the regular uniform, which should now be obtained, the conductors' stripe gold and the motormen's silver, and one additional stripe to be added for every additional five years. John W. Boyle, president." There are just 127 men who will be affected by the order, which is the second one announcing an increase of wages within a little over a year. The present wage rate is 13½ cents an hour to conductors and motormen during the first year of their employment. The new order increases it to 14 cents, an increase of half a cent an hour. Conductors and motormen who have been in the service of the road over a year are now earning 14 cents an hour. There is a new arrangement under the new order which will have a tendency to make the employees desire to continue in the employ of the road permanently. Employees who have been on the road over one year will, after July 1, receive 15 cents an hour, and those who have five years to their credit will receive 16 cents an hour.

TOLEDO, OHIO.—The Toledo Traction has just prepared for gratuitous distribution a very neat folder on Toledo. On one side of the folder is a bird's-eye view of the city, showing the principal lines of the street car system, various points of interest in and about the city, Lake Erie Park and Casino, and lastly a diagram and bird's-eye view of the Ohio Centennial grounds. On the reverse side is a brief history of Toledo, something about the location and industries, its population and its wealth, considerable data regarding the street car system, and lastly a history of the Ohio Centennial to date.

SPRINGFIELD, OHIO.—The suit of S. L. Nelson against the American Railways Company, in which the plaintiff asks for $70,000 commissions for the negotiation of the deal by which the company purchased certain street railway properties in Dayton, has been removed to the Federal Courts, at the request of the defendant.

COLUMBUS, OHIO.—A resolution was adopted by the Board of Public Works a few days ago, declaring void the franchises held by the Columbus Railway Company as successor to the Columbus & Westerville Electric Railway Company. The original franchises covering a number of important streets were granted in 1894, and, although the time limit has been repeatedly extended, the roads were never built.

HARRISBURG, PA.—Writs of quo warranto were issued June 22 by Judge Simonton, at the instance of Attorney-General John P. Elkin, against the following street railway companies: Washington & Belle Vernon, Belle Vernon & Fayette Street, Fayette County & Belle Vernon and North Belle Vernon, requiring them to show cause by what authority they claim to have and use the rights and processes, privileges and franchises of such corporations. These companies were chartered by the State, Dec. 12, 1899, but since that period no railway has been constructed or operated upon any part of the routes mentioned in their charters, by reason of which the rights of these companies to exist as corporations have become forfeited to the commonwealth.

PITTSBURGH, PA.—On June 26, George W. Stern, of New York, filed two suits in equity in the United States Circuit Court against the directors of the Consolidated Traction Company and the Union Traction Company, consisting of C. L. Magee, Joshua Rhodes, B. F. Jones, T. H. Given, George I. Whitney and John A. Bell, of Pittsburgh. Stern prays for an accounting of dividends paid in excess of earnings of the company as dividends on preferred stock, and that they be particularly ordered to pay the treasurer $360,000 paid out after notice of dividend No. 6; that defendants be ordered to repay the Consolidated Traction Company amounts unlawfully received by them, purporting to be paid as dividends, and also that a receiver be appointed. Stern claims to be a holder of 500 shares of common stock. The case will come up in the November term of court.

PITTSBURGH, PA.—The Consolidated Traction Company has awarded a contract for 42 miles of feeder cables. The new cable will be used largely to supply current for the operation of several extensions now under construction.

KENOSHA, WIS.—At a meeting of the City Council, June 25, the Haynes-Clausen Street Railway franchise was passed to its final reading. The franchise carries a resolution attached demanding that the promoters file a satisfactory bond within seven days with the Northwestern Loan & Trust Company, of Kenosha, indemnifying the property owners on three paved streets for 7 ft. of paving. The franchise calls for a through and local line, which will form the completion of the electric system between Milwaukee and Chicago, when the line shall have been extended through to Waukegan. By the conditions of the franchise they are bound by $60,000 more for the performance of their contract. The franchise promoters are P. F. Haynes and G. L. Clausen, of Chicago.

MILWAUKEE, WIS.—The Wisconsin Supreme Court has denied the application of the Milwaukee Electric Railway & Light Company for permission to build under the franchise granted by the Mayor and City Council last January. This decision will keep the original injunction granted by Judge Ludwig in force, and will prevent the company from proceeding with the construction of any of the lines until a verdict is rendered by the Supreme Court.

TORONTO, ONT.—The employees of the Toronto Street Railway Company have formed a new court of the Independent Order of Foresters and named it the "Electric." The initial membership of the organization is eighty members.

MONTREAL, QUEBEC.—Considerable comment is said to have been caused in Montreal municipal circles by the application from the Montreal Terminal Railway (the old Belt Line) to continue its service through the city. The application was referred to the road committee of the City Council, and will probably be resisted by the Electric Street Railway Company on the ground, frequently urged heretofore, that the granting of such permission would be a violation of the contract between the company and the city. However, legal opinions have been given to the effect that under its contract the street railway company has no monopoly of the city streets. It appears that if the Terminal Company obtains the desired permission it will construct one or two electric car lines from one end of the city of Montreal to the other, connecting with its suburban system in the east end of the island. Some time ago this company endeavored to make arrangements with the Street Railway Company to run Belt Line cars to the center of the city or to lease special cars of its own connecting the Belt Line suburban service with the center of the city. This being refused, the Terminal Company now seeks to build city lines of its own, as it is empowered to do under its charter from the Dominion Parliament.

MONTREAL, QUEBEC.—A most extraordinary thing occurred in the Canadian Senate recently, almost without a precedent. The Buffalo Railway Company's bill, which was framed to enable it to absorb all the electric railway lines between Buffalo and the mouth of the Niagara River on both sides of the line, had passed the railway committee of the House of Commons, received its three readings and also received the assent of the Commons, was sent up to the railway committee of the Senate. It was passed by that body and received its first and second reading in the Senate, which is usually tantamount to a bill being passed, but, on its coming up for third reading, which is usually only a formality, it was thrown out. The company was incorporated in New York, and this action affects the Cataract Power Company, Hamilton Electric Street Railway, the Hamilton & Dundas Electric Company, Hamilton, Grimsby & Beamsville Electric Railway, Hamilton Radial Electric Railway, Galt, Hespeler & Preston Electric Railway, Niagara Falls Park & River Railway, Buffalo & Niagara Falls Electric Railway, Niagara Gorge Electric Railway, Buffalo, Tonawanda & Niagara Falls Electric Railway, Buffalo & Lockport Electric Railway, Niagara Falls & Suspension Bridge Railway, Niagara Falls, Whirlpool & Northern Railway and several others, proposed, building or being extended.

CONSTRUCTION NOTES

PASADENA, CAL.—The board of directors of the Pasadena & Mt. Lowe Railway Company have called a meeting of its stockholders for Aug. 2, to vote upon the questions of increasing the capital stock from $400,000 to $600,000 and increasing the bonded indebtedness from $375,000 to $500,000 by a new issue of 500 4 per cent $1000 thirty-year gold coupon bonds, which are to be used in redeeming the present outstanding bonds and for betterments, extensions and re-equipment of the line.

HARTFORD, CONN.—T. C. Perkins, of Hartford, has made application to the Selectmen of Agawam for the construction of an electric railway between Springfield and the Connecticut State line. Mr. Perkins' petition calls for two locations, both beginning at the State line and ending at what is called the South End bridge at Springfield. One of these, however, goes around through the center of the town of Agawam, and the other goes up along the river road. The company prefers to have the latter granted, but will take the former if the people of the town prefer. It is the intention of the promoters of the new road to run a fast line between Hartford and Springfield, and they hope to make the trip in an hour and a half.

WABASH, IND.—Joseph T. McNary, general manager of the Logansport, Rochester & Northern Traction Company, which is to build a trolley line 101 miles in length, from Logansport to Kendallville, says work will commence on the grade of the road at Logansport July 4. The money for the construction work has all been provided, and but for the illness of the civil engineer in charge of the work operations would have commenced six weeks ago. One section of the road will be in operation by fall.

KOKOMO, IND.—It is said that a company, to be known as the Kokomo, Wabash & Lake Manitou Railway Company, is to be incorporated shortly. The company is being organized to construct an electric railway from Kokomo to Rochester via Greentown, Converse, Wabash, Roann and Akron. The right of way has been obtained along the entire route, and negotiations are now on for financing the road. Franchises have been granted in all the towns on the line, and the promoters are reported to have said that the enterprise is certain to go. The road will be about 60 miles long and traverse a populous and wealthy region.

FT. WAYNE, IND.—The Ft. Wayne & Butler Railway Company has been incorporated, with a capital stock of $50,000, to construct an electric railway from Ft. Wayne to Butler, a distance of about 40 miles. The directors of the company are Robert H. Carnahan, B. Paul Mossman, Robert Millard, William H. Olds, Charles W. Orr, Van B. Perrin and Frank L. Smick.

DAVENPORT, IA.—The Tri-City Railway Company is having a part of its system double tracked in the vicinity of Warren Street. B. F. Nickerson, of the Falk Company, of Milwaukee, Wis., has charge of the work. It is expected that the job will be completed in about a month.

AUGUSTA, MAINE.—The Gardiner & South Gardiner Electric Railway Company has filed a petition with the Railroad Commission for a location. It is proposed to connect the city of Gardiner with the village of South Gardiner. The road will form one of the connecting links in the projected system between Augusta and Portland.

SEDALIA, MO.—The receivers of the Sedalia Electric & Railway Company contemplate making a number of improvements in the street railway system. The power house on East Broadway is to be enlarged, and a new car house is to be built on East Ninth Street. The latter will be 120 ft. x 50 ft. The installation of additional power-house machinery is contemplated, and several new cars are to be purchased. The old cars are to be overhauled and refitted.

ST. LOUIS, MO.—The Wellston, Creve Couer & St. Charles Railroad Company has petitioned the St. Louis County Court to allow an amendment to its petition of April 9, which asked for a permit to lay tracks on the National Bridge Road. The amendment requests a private right of way.

KANSAS CITY, MO.—The Metropolitan Street Railway Company is rushing work on its Eighth Street viaduct, and expects to have it completed within six weeks. The total length of the viaduct is 650 ft., and is just wide enough for two tracks. Seven hundred thousand pounds of steel have been used in building it, and the largest of the big girders that have been used weighs 20,000 lbs. This great mass of steel and the concrete approaches made a solid and durable base. The foundation has been put down to bedrock—that of the west approach being 34 ft. below the street grade. In order to meet the demands of property owners that the structure should be sightly and impervious, the whole track space will be covered with steel plates over girders on which ties are laid imbedded in bituminous concrete. On top of the ties ducts will be laid, carrying feeder cables, the ducts being imbedded in and surfaced over with sheet asphalt, giving the viaduct from overhead the appearance of an ordinary double-tracked street railway on a paved street. Eighty-pound rails will be used on the viaduct, and a safety appliance will be provided by an inner and outer guard-rail and guard-rails at the approaches. Except at the Main Street station, the viaduct has an incline of 6 ft. to over 100 ft.

GREENSBORO, N. H.—The City Council has passed an ordinance granting the Guilford Power Company a franchise to construct a street railway in Greensboro. The franchise is for thirty years, and provides for a single-track system, with one exception. The price of transportation is to be 5 cents within the city limits and six tickets are to be sold for 25 cents.

MIDDLESEX, N. J.—The South Amboy Borough Council has passed an ordinance granting the Middlesex & Somerset Traction Company a franchise for the construction of an electric railway through the borough.

NEWARK, N. J.—The North Jersey Street Railway Company formally opened its new line on Jackson Avenue, Greenville, June 28.

NEWARK, N. J.—The North Jersey Street Railway Company has commenced the operation of cast-welding its track joints. The Falk system is being used, and a 1-ton cupola has been purchased, together with the right to use it without paying royalties. From ten to eighteen joints are cast per ton of iron, according to the size of rail, and both new and old rails are being welded. Work is being carried on every pleasant night, but it will be some time before the entire undertaking is finished.

ALBANY, N. Y.—The United Traction Company has awarded J. M. Jones' Sons' Company a contract for twenty-five cars.

CATSKILL, N. Y.—The Catskill Electric Railway Company has purchased the necessary poles, ties and rails for the construction of 2½ miles of its proposed road, and is in the market for other supplies. The work of construction, placing of orders for equipment, etc., is in charge of Fowler & Robert, the well-known supply firm, of 149 Broadway, New York. Mr. Robert states that all orders will be placed immediately, and the road will be finished as soon as possible.

NEW YORK, N. Y.—On June 21 the Rapid Transit Commissioners voted to change the route of the subway at the northern end of the West Side line, so that it will go north in almost a straight line over a viaduct from the portal of the tunnel at Hillside Avenue to the terminus at 218th Street via Nagle, Eleventh and Tenth Avenues, instead of making a detour to the west through Ellwood Street to Inwood. The change will save 1000 ft of viaduct and $100,000 in the cost of building. Contractor John B. McDonald approves the change because the new route will be through a more thickly settled section and will pay better when the road is in operation.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

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Canadian Capital in the West Indies

Sir William Van Horn and James Hutchinson, of Montreal, and B. F. Pearson, of Halifax, are the principal members of a syndicate which is actively building and operating electric railways and lighting plants in the West Indies, among the latest ventures being a 10-mile railway at Demerara, and a 12-mile railway in Trinidad. The former will use Westinghouse 12A motors, single motor equipment, and in the power house will be Robb engines and one direct-connected 200-kw and one belted 100-kw Westinghouse generators.

Chicago Consolidated Traction Suit

Application has been made to the Circuit Court at Chicago by Sutro Brothers & Company, of New York, for an injunction to prevent the Chicago Union Traction Company from controlling the company. Sutro Brothers hold 700 shares of the stock of the Chicago Consolidated Traction. The claim made by Sutro Brothers & Company is that the mortgage for $6,750,000 was made by the Chicago Consolidated Traction Company with its own stock as collateral, as part of a plan to evade the law forbidding the purchase by one corporation of another corporation.

Street Car Riding as a Cure for Insomnia

After careful investigation a prominent Louisville physician announces that the most expeditious cure for insomnia is trolley car riding. He advocates a ride of about two hours before bed time, and says that a sound night's sleep will be enjoyed if his instructions are followed. "Two hours before bedtime," says he, "put on your most comfortable clothes, your easiest shoes and your least choky collar. Then walk to the nearest car line, take a front seat in the first open car that comes along, and sit there till time to go to bed, riding from one end of the line to the other, with the cool night wind blowing in your face. An hour's street car riding scarcely ever fails to bring on a feeling of drowsiness, and it has actually been able to bring sleep to the most nerve-wrecked of insomniacs by this simple device."

State Tax Board Must Review Assessments on Metropolitan Street Railway System

On July 6 Justice Herrick granted writs of certiorari directing the State Board of Tax Commissioners to review their assessments under the franchise tax law of sixteen railroad companies doing business in New York City. Following are the companies represented: Metropolitan Street Railway, Eighth Avenue, Sixth Avenue, Ninth Avenue, Second Avenue, Fulton Street Railroad, Twenty-Eighth & Twenty-Ninth Street Crosstown Railroad, Broadway & Seventh Avenue Railroad, Bleecker Street & Fulton Ferry Railroad, Thirty-Fourth Street Crosstown Railway, Central Crosstown Railroad, Christopher & Tenth Street Railroad, Twenty-Third Street Railroad, Central Park North & East Railroad, Forty-Second Street & Grand Street Ferry Railroad, and New York & Harlem Railroad Company, City Line.

Camden Company Rewards Faithful Employees

The employees of the Camden & Suburban Railway Company were given a surprise at the monthly "discussion night" of the Employees' Association in their rooms, July 9. After a discussion on "Car Brakes" a series of engrossed resolutions were presented to the directors. Later Superintendent Harrington, of the company, distributed envelopes to certain persons as their names were called. They found that those who had been in the employ for five years were given an order for a suit of uniform clothes and were entitled to wear one stripe on the arm. For service from ten to fifteen years, the order called for two suits of clothes and two stripes. For those more than fifteen years, orders for a summer and winter uniform and an overcoat were given. Simeon Matlack, the oldest employee, will be entitled to wear five stripes. He has been connected with the company for more than twenty-seven years.

Liability of Elevated Roads for Damages to Abutting Property

The finding of the lower court at Chicago in favor of a West Lake Street property holder in a suit brought against the Lake Street Elevated Railroad in which he alleged damages on three grounds, namely, interference with light and air, and noise, and with ingress to and egress from the property, has been overruled by the Appellate Court, and judgment entered for the defendant. The

higher court holds that the structure does not interfere with ingress and egress by the streets, and says that specific proof must be shown as to the damage resulting from interference with light and air and from noise. In reference to smoke and noise the court quotes from a decision in another State as follows: "These in the form in which they appeared to exist from the proofs were incidents of city life and not substantial injuries." From another decision the court quotes: "The owner of land abutting on a street holds title subject to the inconveniences and injurious consequences, including those occasioned by noise and vibrations resulting from a user which is consistent with the legitimate and proper use to which a public thoroughfare was dedicated."

Court Upholds Assessors' Street Railway Valuations at Detroit

The Wayne Circuit Court has decided that franchises are assessable, and that the street railway companies must pay taxes on the increased assessment made by the board of assessors. The court holds: That all franchises are taxable as personal property; that the city has no authority to bargain in taxation, but must assess the property of all corporations alike; that if any property is to be exempted from taxation, all must be; that no property must be required to bear more than its just share of the burden of taxation.

The assessment made this year by the board of assessors is as follows:

Detroit Citizens' Railway Company	$5,521,100
Ft. Wayne & Belle Isle	1,051,200
Detroit Electric Railway Company	1,569,800
Grand River Avenue Line	2,104,900
Total	$10,247,000

The assessment last year was:

Detroit Citizens' Railway Company, including the Grand River Line	$1,500,000
Ft. Wayne & Belle Isle	300,000
Detroit Electric Railway Company	800,000
Total	$2,600,000

The street railway companies stated that they will carry the case to the higher courts. If the decision is sustained the companies will have to pay the city taxes as follows:

Detroit Electric Railway	$23,832
Grand River Line	31,956
Detroit Citizens' Company, on suburban line out Jefferson Avenue	759
On North Woodward Avenue	2,277
On Mack Avenue	227
On Gratoit Avenue	91
Rapid Railway	3,340
Detroit, Ypsilanti & Ann Arbor	5,389
Detroit & Northwestern Railway	309
Total	$68,180

Big Deal in Philadelphia

A special dispatch from Philadelphia announces that the Investment Company of Philadelphia has secured control of the Railways Company General. As a part of the arrangement, the company receives about $300,000 new cash capital, $200,000 of which will be applied to liquidate the entire floating debt, and $100,000 to retire underlying bonds. It is announced that there will be no additional issue of stock or bonds. The authorized stock of the company is now $10,000,000, of which $1,500,000 is outstanding. L. N. Downs has resigned as president of the Railways Company General, and is succeeded by Evans R. Dick, president of the Investment Company. John B. McAffee will remain as vice-president and general manager of the company. The new directors of the company are: Evans R. Dick, J. Ogden Hoffman, R. H. Rushton, representing the Investment Company, and J. Cooke, of C. D. Barney & Co. J. W. Supplee, late president of the Corn Exchange Bank, had accepted a position as director, but his sudden death leaves the place vacant. The retiring directors are: Edwin S. Cramp, Dr. W. H. Chestnut, Major L. N. Downs, Richard Ellis and Edwin F. Glenn. The old members who remain in the board are: George S. Graham, W. W. Gibbs, S. B. Vrooman and Robert J. McKinstry.

The Railways Company General was incorporated in August, 1899, under New Jersey laws. It owns and controls the following properties: Montoursville Passenger Railway; Milton, Lewisburg & Watsontown Electric Railway; Philadelphia & Bristol Passenger Railway; Michigan Traction Company; Elmira & Seneca Lake Railway Company; Newtown Electric Street Railway and American Engineering Company.

San Francisco Transfer Ordinance Held Valid by the Supreme Court

The Supreme Court of California has rendered a decision declaring the San Francisco transfer ordinance valid. The ordinance is designed to correct and prevent abuses of the transfer system by requiring a street car passenger to use his transfer within the time limit, and prohibiting him selling or giving it away. This verdict is a decided victory for the companies, and will put a stop to fraudulent practices of ticket sharps, etc.

The ordinance was attacked on the ground that it violated the guaranty of personal liberty contained in the constitutions of United States and the State of California; that it was an unconstitutional interference with a right of private property; that it was arbitrary, oppressive, and unreasonable; and that it was an illegal attempt to enforce the obligations or assumed obligations of private civil contracts by penal legislation.

After a review of these contentions the court held that the ordinance was valid. In regard to the argument that the ordinance was an attempt by penal legislation to enforce a private civil contract, or, in other words, that it was an attempt to compel the passenger who has received his transfer to use it within the limits of his contract, and not to violate that contract by giving it to a person who might make improper use of it, the court said: "Could it be perceived that this was the only purpose, or even the main purpose, of the ordinance in question, we should be inclined to hold that the objection was fatal, but we cannot perceive that its main object or design was to accomplish this result. Rather, we think it clear that its primary object is to protect and advance the convenience and welfare of the traveling public; for if, to the legislative mind, an abuse of the transfer system has grown up, the inevitable result of such unrestricted abuse must be one of two things—either that transfers would be discontinued entirely, to the material injury of the community, or the transfer system would be hedged and safeguarded by onerous conditions and requirements for the protection of the company, which would work great inconvenience to the passengers. It was certainly right for the supervisors, if they saw or anticipated the existence of such an evil, to destroy or avert it by proper legislation tending to correct the abuse, and it is no objection to the validity of an ordinance designed for this purpose that it may incidentally tend to prevent frauds and compel men honestly to abide by their contracts."

The St. Louis Strike on Again

The great street car strike at St. Louis was declared off on July 2, and was declared on again July 10, the executive committee of the local union declaring that the St. Louis Transit Company had violated the contract which was signed by both parties on July 2. This agreement follows:

1. The provisions of the agreement of March 10, 1900, as to rates of pay and hours of service will be continued in force by the company.
2. Every employee of the company to be free to join or not to join any organization, and no discrimination to be made for or against him because of the manner in which he exercises his freedom.
3. Any attempt on the part of any employee to induce another employee by intimidation or threats to join or not to join any union shall be cause for immediate discharge of the person guilty of such attempt.
4. Any attempt to influence any employees by an official of the company to join or not to join any union shall be cause for discharge of such official.
5. The company will meet any employee or committee of employees, whether representing themselves, other employees, or an association of employees, regarding any matter of mutual interest.
6. For the purpose of filling vacancies which may now exist or hereafter arise, the committee of former employees, of which T. B. Edwards is chairman, shall prepare a list of the men who were in the company's service on May 7 last, and as the company now or hereafter needs additional men it will select them exclusively from this list until it is exhausted, not interfering, however, with men now in the service. No person shall be eligible to this list who has been guilty of any acts of lawlessness or violence.

St. Louis Transit Company,
by Edward S. Whittaker, President.

T. B. Edwards, Chairman of Committee.

The strike is hereby declared off.

T. B. Edwards, Chairman of Committee.

July 2, 1900.

Certain members of the union claim that the company broke clause 6 of the agreement by hiring non-union men since the strike was declared off, July 2. The company enters a general denial of the charges, and says that help contracted for from outside sources before July 2 and who did not arrive till a later date were appointed, but other than this no help has been engaged. The company is in duty bound, the management explains, to give these men positions. It is earnestly hoped that the citizens of St. Louis will not have to tolerate a similar condition of affairs to that which existed during the last strike, and that the present difference be settled speedily. The city authorities should take hold of the situation at once, and prevent a repetition of the acts of the last strike.

The recent struggle between the St. Louis Transit Company and its employees has been worse than famine and pestilence to St. Louis, and it will take many days for the city to blot out the disgrace to its name. The monetary loss to the city is inestimable.

Sixteen lives were lost in the last strike, over one hundred persons wounded by bullets and thrice that number injured by missiles or explosions. In addition to the fatalities and casualties reported, the north and south ends of the city developed a species of brutality never before witnessed in a civilized community, women being stripped of their clothing in the public streets and then beaten for having ridden on Transit cars. As a result of the boycott declared by the strikers, several of the small merchants have been forced into bankruptcy, and nearly every line of business more or less seriously affected.

Japanese Railroad Officials and the Brooklyn Rapid Transit System

In the STREET RAILWAY JOURNAL for June 16 an account was given of a trip over the lines of the Brooklyn Rapid Transit Company, made by Y. Sasaki, general manager of the Nankai Railway,

VIEW OF SPECIAL CAR CARRYING JAPANESE RAILROAD OFFICIALS

and K. Nishino, traffic manager of the Sanyo Railway, of Japan. The engraving above shows the end of the parlor car Columbia, made from a photograph taken in front of the entrance to the Kent Avenue power station of the road. Looking at the picture, Mr. Sasaki will be seen on the extreme right, while Mr. Nishino stands immediately behind. The two other Japanese are New York friends of Messrs. Sasaki and Nishino. The person on the extreme left is John M. High, general sales agent of the Pantasote Company.

The parlor car, with the persons named, and other invited guests, left from the Manhattan end of the bridge at 2 o'clock, and went immediately to the Kent Avenue power station, via the Brooklyn Borough Hall and Myrtle and Washington Avenues, passing the Navy Yard. After a thorough inspection of that plant, the car returned to the Borough Hall, and was met by J. C. Breckenridge, general manager of the B. R. T., who escorted the party through to Fifty-Second Street power house and shops, where everything was fully explained by Eugene Chamberlain, superintendent of equipment. From there the entire party, including also Superintendent Robbins, went to Brighton Beach, where supper was served at the Brighton Beach Hotel.

Messrs. Sasaki and Nishino left Japan November last, and after visiting all the important cities in Europe, came here to study our methods of transportation. Mr. Sasaki left for home the end of June, and Mr. Nishino is now in the West on his way to San Francisco, from which place he will sail week after next. Both gentlemen expressed themselves as much pleased with our decidedly advanced methods of conducting traffic, and spoke also of the great amount of American machinery they had seen in all the countries they visited.

Opening of the Central London Underground Railway

[*From Our Regular Correspondent.*]

A most important event took place June 27, when His Royal Highness the Prince of Wales made a formal inspection of the Central London Railway, which, as readers of the STREET RAILWAY JOURNAL are doubtless aware, is a new underground railway in London, and declared the railway open. The occasion was naturally one of great importance, not only to street railway or tramway men, but also to the railway world in general, and some 500 representative men from all over Great Britain assembled to witness the interesting ceremony. The Prince of Wales arrived at the Bank station of the railway about 3:30 in the afternoon, and was received by Sir Henry Oakley, the chairman of the Central London Railway Company and his co-directors. The station at the Bank is all but completed, and in passing through the station it was noticed that the American system for the collection of fares, as adopted on the elevated railways in New York, was to be utilized in this new London railway, and familiar looking boxes, with the chopping machine handle, were in strong evidence, to which all New Yorkers are well accustomed. Previous to the arrival of the Prince a large number of the guests had preceded him on two other special trains, which made quick journeys from the Bank to Shepherd's Bush, a distance of about 6½ miles, where the central station is situated.

The royal train accomplished the journey in about eighteen minutes, and it is safe to say that even His Royal Highness never traveled in greater comfort than on this occasion. The roadbed and rolling stock of this new enterprise are beyond reproach, and the cars travel as smoothly as it is possible to imagine. At the power house a special platform had been erected, and after the Prince alighted no time was lost in walking into the power house for a short and informal inspection, which the Prince seemed to manifestly enjoy, and to be intensely interested in. Shortly afterward refreshments were served under the direction of the manager of the Carlton Hotel in a large marquee, which had been admirably and most tastefully decorated for the occasion. A large, round table was provided for the Prince of Wales, at which were also seated Sir Henry Oakley, the Duke of Fife, Sir Michael Hicks-Beach, Lord Rothschild, the Marquis of Londonderry, Lord Claud Hamilton, Mr. Henry Chaplin and Lord Stalbridge. The rest of the space was occupied by a number of small tables beautifully decorated with flowers, at which a most recherche luncheon was served, and at some of these tables might be noticed the following gentlemen: Lord Colville, of Culross; the Lord Mayor, Sir Courtenay Boyle, Sir Benjamin Baker, W. L. Jackson, M. P.; Lord Farquhar, Captain Holford (in attendance on the Prince of Wales), Sir Richard Farrant, the Hon. Algernon Mills, the Earl of Cork, Lord Rathmore, Sir Ernest Paget, Sir W. H. Preece, Mr. Perks, M. P.; Sir J. W. Maclure, M. P.; C. F. Gooday, H. C. Stephens, M. P.; Henry Tennant, Francis Hopwood, the Hon. Charles Rothschild, Sir Ernest Cassel, Sir George Lewis, Sir Francis Knowles, Sir John Monckton, Sir Arthur Arnold, John Aird, M. P.; W. Forbes, Lieutenant Co. Yorke, W. H. Turner, Alfred Powell and Sir F. Dixon Hartland, M. P.

There was no formal speechmaking, but the Prince of Wales in a few graceful words, proposed the toast of the Central London Railway, as follows: "I have much pleasure in declaring the Central London Railway open to-day (cheers), and am glad that I

have been asked to take part in the ceremony. I wish to drink success to the undertaking, and to congratulate Sir Benjamin Baker, the eminent engineer, who has constructed this railway. I have little doubt but that it will be a great boon to this city. I am sure you will all join with me in drinking success to the company. (Cheers)." After enjoying the hospitality of the Central London Railway, and evidently greatly enjoying his surroundings, His Royal Highness took train to Lancaster Gate station of the railway, and shortly afterward the company dispersed.

The whole affair in every sense of the word was most successful, and too much praise cannot be given for the manner in which all the arrangements were carried out, and the extremely adequate provision made for the reception of the company's guests. As to the working of the system nothing could be left to be desired. The engines and generators worked with the precision of a well-established plant, and as has already been said, the cars traveled with all the smoothness that could be desired on the most perfect steam railroad in the world. The Central London Railway Company is certainly to be congratulated upon the completion of a most magnificent piece of mechanical and electrical engineering, and the British Thomson-Houston Company, contractors for the electrical work, and H. F. Parshall, the electrical engineer, are also to be congratulated upon the success attending their part of the work.

The ceremony was one of the most pleasant, most agreeable and most interesting which I have ever attended, and I think will be long remembered by those who had the good fortune to be present.

A. C. S.

Operating Work as a Feature of Electrical Laboratory Training *

BY WM. S. ALDRICH

In the representative institutions the engineering courses are now so organized that the junior student enters the engineering laboratory fresh from work in the physical laboratory. Advanced work along similar lines is carried on in many cases after the student has entered upon his professional studies. The earlier training is chiefly by way of illustration and demonstration, familiarizing the student with the phenomena, principles and laws of physics. The later training acquaints the student with some of the exact methods of modern experimental work. In consequence of such work, the engineering student should early assume toward all phenomena and problems in the realm of physics that attitude so characteristic of the scientific mind. Granting its thoroughness there is less necessity for attempting similar training in the engineering laboratory. More time is, therefore, available for developing the latter along engineering lines.

The work of physical and of engineering laboratories naturally overlap each other. No hard and fast line can be drawn between them. It becomes daily more impossible to define clearly their respective limits with each advance in physical science and growing industrial applications of the same. In the engineering laboratory are investigated the properties of water, steam, gas and electricity with special reference to their industrial applications; the chemical, physical, mechanical, electrical and magnetic properties of materials, as the case may require; the functional relations of mechanisms, machinery and prime movers, and their performance in detail or in the aggregate.

The bearing of these considerations upon electrical laboratory training is obvious. Preceding experimental work with new electrical appliances or processes there should be carefully arranged work along the following lines: study, inspection, illustration and demonstration, operation. By thorough study of actual and typical appliances the necessary preliminary electrical and mechanical data are secured. By inspection the student is assured of the electrical, magnetic and mechanical condition of the apparatus essential for successful operation of the same. By way of illustration and demonstration he is familiarized with the phenomena and principles underlying the functional working of apparatus and the handling of instruments and circuits. By operation the student acquires that familiarity, facility, confidence and resourcefulness so essential for the satisfactory handling of electrical circuits and appliances.

Training in handling electrical machinery is quite as essential as training in electrical measurements. The one should be done and the other not left undone. If with all of his familiarity with galvanometer work the young electrical engineer is left to the mercy of the wireman or the operating engineer, his laboratory training has been incomplete. A knowledge of the behaviors of electrical machinery and confidence in handling electrical circuits is becoming more necessary with each widening use of electricity. The utilization of alternating currents and the operation of alternating current machinery constitute to-day a most interesting and important field, one with which the electrical student cannot become too familiar. It is the result of experience that students who have been given a course of electrical laboratory training involving study, inspection, illustration and operation have a better understanding of testing work than if they had been put at once into the latter without attention to the former.

* Abstract of a paper read before the Society for the Promotion of Engineering Education, New York meeting, July 2-4, 1900.

Calculation of Distributing Systems of Electric Traction Under British Condtions IV.

BY H. M. SAYERS

(Continued from page 602.)

APPENDIX No. IV.

CALCULATION FOR TRACK FEEDER, EAST OF T

Rail resistance, .0289 *w* per mile.
Drop allowed, 5 volts.
Amperes × miles constant for 5 volts = 173.
Current per car, 15 amps. Cars passing in pairs.
From T Eastward.

Cars		Amp. miles	Product	Sum
T to F, 5 cars, .9 miles.	First pair	30 ×	.3 = 9	
	Second pair	30 ×	.6 = 18	
	One at F	15 ×	.9 = 13.5	
	Two on line D F	30 ×	.9 = 27	67.5
F to G, 4 cars, 1.25 miles.	First pair	30 ×	1.21 = 36.3	103.8
	Second pair	30 ×	1.83 = 54.9	158.7
	Two on line N G	30 ×	2.15 = 64.5	223.2

As the sum is brought over the constant by the current flowing in at G from branch N G, G should be a point of change of direction. The product of amperes × miles on branch N G is 15 × 1.1 = 16.5. This added to the 158.7 at G = 175.2, a little over the limit. Hence the whole of the 30 amps. from branch N G should flow east, and the integral of ampere miles from G to feeding point should be 173 — 16.5 = 156.5, to keep N at 5 volts.

Then from G Eastward. Section G O, four cars.

1.5 miles long. Currrent flowing east 30 amps. from branch N G.

Cars	Amp. miles	Product	Sum
At G	..	16.5	..
G to first pair	30 × .375 =	11.25	27.75
First pair to second pair	60 × .75 =	45.00	72.75
Second pair to O	90 × .375 =	33.75	106.50

H being terminus, and only two cars between H and O, it is obvious that feeding point should be west of O, so sum westwards from H. H to O 1 7 m.

Cars	Amp miles	Product	Sum
First pair to O	30 × .85 =	25.5	
O to second pair G O	30 × .375 =	11.25	36.75
Second to first pair G O	60 × .75 =	45.00	81.00

Feeding point will thus be between the first and second pair of cars east of G. It should be exactly .825 miles east of G. The product from this point will be 54.75 to the terminus H and to N, corresponding to 1.58 volts drop. Hence the feeding point may be 3.42 volts above earth.

The track feeder will have to carry back 120 amps., and be 2975 miles long. Section should be .39 sq. in., and the drop in it will be 15.06 × 2.975 = 45 volts. But as its end may be 3.42 volts above earth, the booster will have to give only 41.58 volts, and have an output of 41.58 × 120 = say, 5000 watts.

TRACK FEEDER NO. 2

From T Westward

It is obvious to inspection that some current should return *via* D and some *via* J. The dividing points should be those at equal distances from T by each route.

On the branch D J this point is practically at the center of its length, hence half the total current is taken as flowing each way.

On the circuit T D C I J T, it is very close to the junction, I. Hence the current returning by J will be half that on the branch D J, and the whole of that on branches from J to I, K and L respectively, making altogether 8.5 × 15 = 127.5 amps., which gives at once the section of the track feeder from T to J. It also follows that the potentials of points D and J should be kept equal. Find feeding points, etc., as before.

T to D, seven cars, 2.35 miles. Branch C M, four cars = 60 amps. at .35 miles from T.

Assume one car at D, the other six in pairs at .59, 1.18 and 1.77 miles respectively from T.

* Paper read before London Institution of Electrical Engineers, May 3, 1900.

CURRENT EASTWARD TOWARD T

Cars	Amp. miles	Product	Sum
T to C	60 × .35 =	21.00	
T to first pair	30 × .59 =	17.70	38.7
T to second pair	30 × 1.18 =	35.40	74.1
T to third pair	30 × 1.77 =	53.10	127.2
T to D	15 × 2.35 =	35.25	162.45 = 4.7 V
T to O, part current from branch D J	44 × 2.35 =	10.5	173

giving 5 volts at D.

CURRENT WESTWARD FROM D

D to C, 1.65 miles, six cars, passing at .41, .82, 1.23 miles from D, 33 amps. from branch D J also :

Cars	Amp. miles	Product	Sum
D to first pair	33 × .41 =	13.53	
First to second pair	63 × .41 =	25.83	
Second to third pair	93 × .41 =	38.13	
Third to C	123 × .41 =	50.43	127.92 at C

Count back from A to find equal point.

A to B, 2 miles, three cars, assume one at A, two in middle.

CURRENT EASTWARD FROM A

Cars	Amp. miles	Product	Sum
A to first pair	15 × 1 =	15	
First pair to B	45 × 1 =	45	60

B to C, 1.1 miles, two cars, assume in middle, current of one car from branch B J. Continue summing from A.

Cars	Amp. miles	Product	Sum
B to middle	60 × .55 =	33	
Middle to C	90 × .55 =	49.5	142.5 at C

This indicates feeding point a little west of C, but as 60 amps. more enter from branches north and south of C, and C is the meeting place of four tracks, it is clearly the proper place for the feeder to tap the rails. If this point be kept at earth potential, A, the point furthest from T will be at 4.1 volts above earth.

The feeder will be 4 miles long, have to carry 273 amps. back, have a section of .89 sq. in., will drop 4 × 15.06 = 60.24 volts, and booster must give 273 × 60.24 = 16,445, say 17,000 watts.

TRACK FEEDER NO. 3

Inspection of the diagram suffices to show that J must be the feeding point for this. The greatest drop thence will be on branch J K, 2.2 miles long with two cars. Assume one at K and one half way, then ampere miles K J will be 41.25 or 1.2 volts. J must then not be more than 3.8 volts above earth. This is lower than D, so that more than the half current on line J D will return by the feeder *via* J. *Per contra* part of the current from branch I J will go *via* I C. The assumed distribution could be obtained by splitting the feeder at J, and connecting the branches at proper points on the three lines J L, J K, J I.

No practical advantage would result, as in working the load on each feeder is regulated to keep the pilot wire indications within proper limits, by control of the booster e. m. f., and it is quite certain that the actual load and its distribution will vary widely and rapidly in any given case from any assumed distribution, consequently in a network requiring a number of track feeders it is sufficient to ensure that they shall be provided of needful section and number to enable the P. D. on the rails to be kept within limit, and refined investigation of the current distribution is likely to be labor lost.

Hence No. 3 feeder may be safely taken as tapping rails at J. It will be 2.15 miles long, carry 127.5 amps., have a section of .415 sq. in., drop 32.4 volts, and require a booster to give 32.4 × 127.5 = 4130, say 4200 watts.

DISCUSSION

The following digest of the discussion on Mr. Sayers' paper is taken from the London *Electrical Review*:

The discussion was opened by Prof. Andrew Jamieson, who regarded the paper as one which contained a great deal of sound matter requiring special study. He referred to his visit to Cape Town in connection with the tramways there, and stated he found no less than thirty volts between the end of the lines and the power house. The result was electrolytic troubles and disturbance on the submarine cables. He advocated the use of boosters. Owing to the extraordinary character of the slate formation, forming a basin in which Cape Town lay, the rails returned only about 70 per cent of the current, and 30 per cent went out to sea.

Mr. Taylor spoke of the paper as being a thoroughly practical one, discussing in detail the advantages from a distributing standpoint of the single and double station and the polyphase system. He had applied some of the calculations to light railways. Advocates of high-tension transmission might try to reduce the costs of that method, but even supposing that those items most readily dealt with were halved, it would reduce .352d. to .292d. only. Mr. Sayers had taken a case rather in favor of the polyphase transmission, as he assumed 28½ miles of track, fifty-seven cars, and a heavy car mileage per annum. Attendance at the sub-stations reckoned at 3s. per week each seemed distinctly low and rather in favor of polyphase. The high losses were due to transformers. Mr. Taylor then showed how the cost was effected by frequency of service, and discussed whether the question of distance of transmission did or did not depend upon the distribution of traffic. He dealt with the arrangement of boosting described in the paper, which only appeared to allow for boosting on the portion of the length of trolley line supplied, and not also on the feeder line to the section fed by it.

Eustace Thomas took up the question of most economical distribution, and gave, as his opinion, that generally the systems put down had regard to first cost rather than economy. It perhaps seemed absurd to talk of another way of putting Kelvin's law, but it was apparently more accurate than the ordinary mode of expression. Take out the cost of 1 mile of cable; if any given size be taken, it is a question whether it would not be better to have a larger size. Let the resistances of the cables be R_1 and R_2, then the power wasted in each would be $R_1 K_1$ and $R_2 K_1$, while the interest, etc., charges would be $P_1 K_2$ and $P_2 K_2$, and to get the best result,

$$(R_1 - R_2) K_1 = (P_2 - P_1) K_2$$

or

$$\frac{R_1 - R_2}{P_2 - P_1} = \frac{K_2}{K_1}$$

where $\frac{K_2}{K_1}$ depends only on the system adopted, and not on the size of the cables. For a given case he had worked out, the figures were:

$\frac{19}{16}$ > 406

$\frac{19}{15}$ > 624

$\frac{19}{14}$ > 1,130

$\frac{19}{13}$

$$\frac{K_2}{K_1} = \frac{C^2 \times \text{hours per day and cost of extra unit from station.}}{\text{Percentage rate of interest, maintenance and depreciation.}}$$

and the result gave 616, showing that about $\frac{19}{15}$ was the most economical size.

Mr. Jenkin pointed out that the paper did not compare the one and two station, and the polyphase systems of supplying tramways; interesting as it was, the matter could not be generalized. He thought feeders should be run to separate sections of line, and two cars might connect the feeders at different parts of the line.

E. K. Scott thought the polyphase system would have shown better if taken at 5000 volts instead of 2500 volts. No attention at the sub-station would be required if the polyphase system were assumed to be used directly on the cars.

Mr. Swinburne had always some fear in discussing such a paper, but he regarded the risk of a departure from accuracy to get simplicity as very real. Under actual circumstances, insulation comes in; this does not vary as the cost of copper, and Kelvin's law in its simple form does not apply. Another element was the eating of pipes that were "not ours," the private individual could not do so, but he supposed tramways could eat pipes as much as they liked provided they followed the Board of Trade regulations. Seriously, the corrosion of pipes, he was afraid, would be most serious. He thought the three-wire system had not been sufficiently considered, but the present Board of Trade rules will not fit three-wire systems. He supposed the reason why this method had been overlooked was that some American had said they did not do such things in America. He wished to state that the booster system is perfectly applicable to the three-wire system, and the bigger the system is the easier it would be to manage. Finally, the way out of the difficulty would be to put a booster on pipes.

E. T. Carter asked if the three-wire system was not in use on the City & South London Railway, and Mr. McMahon said it was, and the balancing was effected by battery and sub-station balancers.

R. C. Quin differed from Mr. Sayers as to a drawing-in system for cables. He had used both, and concluded that if you draw in you will have to draw out, whereas if laid solid, or buried, not only is cheapness gained, but no necessity will arise for removal. He, as a municipal and tramway engineer, preferred granite setts between tramlines, because the traffic was always heaviest on the crown of the road, and the granite setts tended to keep down the excessive wear. He regarded reliability as worth something more than a few pounds, and with all transformer systems there was something to break down.

Major-General Webber compared tramway and telegraph pole fixing and cable systems, and severely criticised the way in which trolley poles were erected in many cases, a neglect of the stresses and strains being shown. He advised tramway engineers to study the question of strains on poles, and learn what they could from the experience of telegraph engineers.

Mr. Sayers, in reply, felt happy that there had not been much contradiction or destructive criticism. He admitted his estimate

of attendance on sub-stations (3s. weekly) was low. The greatest density of traffic affected the size of feeders, and not the distance of distribution. He considered the method he gave for calculation more general than that of Eustace Thomas, as one got the general expression for the most economical density. He did not profess to compare systems. Each section of trolley wire would, of course, be fed at many points. He thought E. K. Scott quite right as to use of motors on cars, and that Mr. Swinburne's remarks were worthy of attention; the difficulty was to find anyone who would put down money to equip such a system. The trouble lay in shorts and turn-outs. It would require a paper to reply to Mr. Quin, but the life of a cast iron pipe was forty years, and he did think that that provision is worth greater attention.

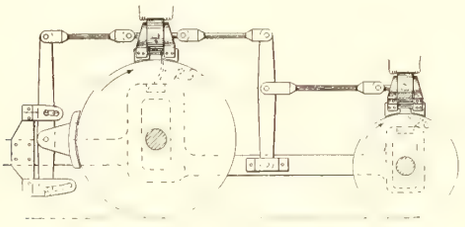
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED JUNE 26, 1900

652,248. Fish-Plate; W. H. Connell, Wilmington, Del. App. filed March 18, 1898. The plate is provided with three inwardly turned flanges, one of which presses against the under side of the tread, another against the top of the base flange, and the third extends under the base flange.

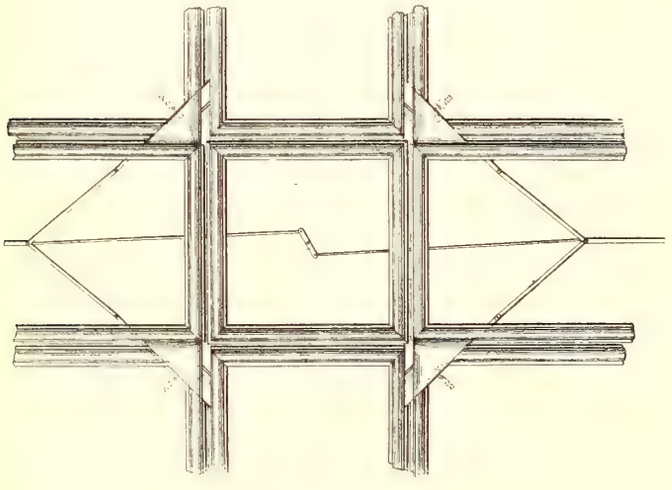
652,265. Railway Tie; R. E. Heller, Abingdon, Ill. App. filed Nov. 28, 1899. The tie is constructed with springs and elastic walls so as to yield under the weight of the train, and make the riding smoother.



PATENT NO 652,266

652,266. Electromagnetic Brake; E. M. Herr, Pittsburgh, Pa. App. filed Nov. 18, 1899. A magnetically applied brake shoe and a mechanically applied shoe are so connected together that when the former is operated, it will also cause the movement of the latter against the wheel.

652,282. Rail-Joint; J. O. Mayhall, Roxie, Miss. App. filed Oct. 21, 1899. The fish-plate interlocks with the rail end in such a way as to prevent longitudinal separation of the rail.



PATENT NO. 653,006

652,415. Repairing Railroad Ties; C. F. Young, Grand Rapids, Mich. App. filed April 4, 1900. A mortise or dado is cut in the tie immediately beneath the rail to receive a removable wooden seat for the rail.

652,487. Rail Joint; J. N. Powers, Shreveport, La. App. filed Feb. 21, 1900. A metal plate extends under the rails and across the joint, and the fish-plates which embrace the rail are bolted to this plate.

652,620. Vestibuled Car; W. M. King, Sr., and H. Jones, Alexandria, Va. App. filed March 28, 1900. The side door of the vestibule is so connected with that portion of the floor above the steps that the latter will be opened and closed when the door is opened and closed.

652,627. Car Seat; W. M. Norcross, Philadelphia, Pa. App. filed April 13, 1900. This invention, which consists of the details of construction relates to that class of seats in which the back section can be swung from side to side, and in which the seat section is tilted or inclined by the act of shifting the back section.

652,613. Overlapping Railway Rail-Joint; F. B. Hart, Manchester, Eng. App. filed April 16, 1900. In rail-joints of the overlapped character the rail ends have bent overlapping webs, provided with extensions beyond the bends, which lie parallel to the ordinary webs of the rail, and are provided with a sufficient number of suitably formed bolt holes for the secure attachment of the rails to one another.

UNTED STATES PATENTS ISSUED JULY 3, 1900

652,767. Tramrailway Track for Public Highways; T. H. Gibbon, Philadelphia, Pa. App. filed Oct. 14, 1899. The tread of the rail is made broad to furnish a track for various kinds of vehicles, including wagons, automobiles and bicycles. The invention relates particularly to the manner of securing the broad tread to the web of the rail.

652,863. Wheel Guard; R. F. Pruesser, Washington, D. C. App. filed Dec. 6. 1899. This is a fender and wheel guard combined, since it is adapted to be thrown down against the roadbed by the motorman to take up an obstruction.

653,006. Railway Crossing; J. S. Jenckes, Jr., Terre Haute, Ind. App. filed April 20, 1900. Blocks are arranged at the crossings of the rails to slide in such a way as to make either of the crossing rails continuous, at will.

653,056. Car-Brake Device; J. S. Baker, Beverley, Mass. App. filed Nov. 7, 1898. This brake is operated by a hand wheel set on a horizontal axis; a clutch is arranged between the wheel and staff, which automatically releases and locks the staff to receive and hold any pressure upon the brake rigging.

653,108. Railway Switch Setting Mechanism; G. W. Mockabee, Washington, D. C. App. filed April 20, 1900. Details.

653,154. Car Fender; J. Sullivan, Boston, Mass. App. filed March 29, 1900. A car buffer and fender; a bar arranged longitudinally under the front end of the car body, and held by a spring, so that its forward end is in contact with the buffer, said bar having a projection on its upper side and a disc on the upright rod, said disc having a tooth or projection in contact with the former projection for operating the fender.

PERSONAL MENTION

MR. EDWIN REED, civil engineer of the Scranton Traction Company, of Scranton, Pa., was married to Miss Esther Smith June 27.

MR. F. L. BEARDSLEY has been appointed superintendent of the Derby Street Railway Company, of Derby, Conn. Mr. Beardsley was formerly assistant treasurer of the company.

MR. W. N. VOORHES has resigned as superintendent of the Smith Street car shops of the Coney Island & Brooklyn Railroad, of Brooklyn. Mr. Voorhes has been in charge of the shops for the past ten years.

MR. FRANK A. DRAPER has recently been appointed superintendent of the Detroit & Northwestern Railway, of Detroit, Mich. Mr. Draper was formerly connected with the Detroit, Rochester, Romeo & Lake Orion Railway, and with the Shore Line.

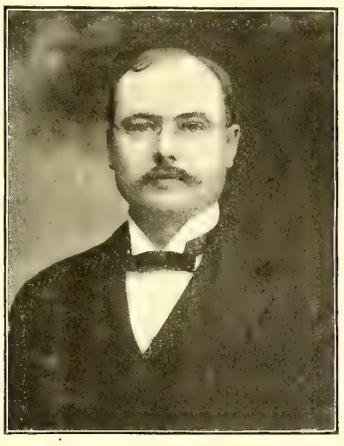
MR. GEORGE F. GREENWOOD, formerly general manager of the Pittsburgh Consolidated Traction Company, and now general manager of the Havana Tramway system, is about to abandon bachelorhood, his engagement to a daughter of Mr. W. M. Doull, treasurer of the Cuban Electric Company, being announced. The date of the marriage is set for July 12, and will occur in England.

MR. CHARLES F. LUTHER, who severed his connections as superintendent of the Pawtucket Street Railway Company, of Providence, R. I., July 1, was presented with a handsome clock by the employees of the company as a token of the esteem in which he was held by them. Mr. Luther has been connected with the street car service of Providence since 1886. He was in turn cashier and secretary and general manager of the company. In 1894 he was appointed superintendent of the company. Mr. Luther is succeeded by George R. Cook.

MR. JULIUS F. PRATT, of Indianapolis, vice-president and treasurer of the Atlas Engine Works, of Indianapolis, died at Glengariff, Ireland, July 7, where he had only recently arrived in

the course of a tour abroad for health and recreation. Mr. Pratt was widely known, and had many business connections. At the time of his death he was a director of the People's Gas Company, Parry Manufacturing Company, Merchants National Bank of Indianapolis, and proprietor of a wheel manufacturing company at Davenport, Ia., beside being connected with the Atlas Works Mr. Pratt was born in Worcester, Mass. Early in life he went West, and eventually settled in Indianapolis, entering the employ of the Woodburn-Savern Wheel Company, of which he later became one of the proprietors. On the absorption of that company by the American Wheel Company he was elected president of the new company, serving in that capacity until the dissolution of the company. He then became interested in the Atlas Engine Works. Mr. Pratt is survived by two daughters, both of whom were with him when he died.

MR. CHARLES O. KRUGER, who has recently been elected second vice-president and assistant general manager of the Union Traction Company, of Philadelphia, has served with the company as its secretary and treasurer since its organization in 1895. Mr. Kruger is also secretary and treasurer of the People's Traction Company, now a constitutent of the Union Traction Company, and has held this position since the organization of the People's Company in 1893. Mr. Kruger is a native of Philadelphia. He was born there on Dec. 14, 1864, and was educated in the public schools of the city, which he attended until January, 1882. On Feb. 21, 1882, he entered the employ of S. & W. Welsh, merchants and bankers, and remained in their employ until elected secretary and treasurer of the People's Traction Company in 1893. To Mr. Kruger has devolved a large part of the organization of system of the Union Traction Company, and the success achieved by that company has been in large part due to his efforts.



CHAS. O. KRUGER

NEWS NOTES

[News notes for this department are solicited.]

LITTLE ROCK, ARK.—The street railway franchise committee has decided to advertise for sale the franchise now being sought by the Little Rock Traction & Electric Company and Mrs. James R. Miller. There is every indication of a spirited fight for the franchise. Mrs. Miller has offered $101,000 for the franchise, and the Little Rock Traction & Electric Company $15,000 in cash for a thirty-year franchise, with 1½ per cent of the gross earnings for the first fifteen years and 2 per cent for the remaining fifteen. The company also agrees to carry the members of the police and fire departments free when uniformed. If they secure the franchise they propose to construct two additional lines, one west on Twenty-Second Street from Main to Ringo Street, and one south on College Street from Ninth Street to Oakland Cemetery.

NEW HAVEN, CONN.—The Winchester Avenue Railroad Company has just published a descriptive booklet of New Haven and West Haven, with illustrations showing views in both cities. The route of the Winchester Avenue Road is described from the Green to Woodmont, and all the points of interest along the road entertainingly treated.

ATLANTA, GA.—Judge J. H. Lumpkin, of the Superior Court, has decided that the Atlanta Rapid Transit Company can cross the tracks of the Southern Railway on Decatur Street, and that the Atlanta Railway & Power Company can cross the tracks of the Southern at Henderson's store, at the end of South Pryor Street. Both companies had been granted franchises which would carry them across the tracks of the Southern at the points named at grade crossing, and when the lines were being constructed with this end in view the steam railroad company filed petitions in each case for injunction. Temporary injunctions were issued pending hearings.

VENICE, ILL.—All connections have been completed and the power turned on the Venice, Granite City & East St. Louis Electric Railway. Cars are now running from Granite City via Venice to East St. Louis.

CHICAGO, ILL.—The Council has granted an extension of franchise, giving the Metropolitan West Side Elevated Railroad Company the right to extend its terminals on two branches, after a contest which defeated temporarily an amendment granting a surface franchise extension enabling the company to run its cars to the grade and continue as a surface line to Austin Avenue. The extension, as granted, enables the Metropolitan to compete with the Lake Street Elevated Railroad Company in the western suburbs. The ordinance grants a fifty-year franchise, the work of extension to be completed within two years. It grants the company the right to extend its Douglas Park branch, between Twentieth and Twenty-First Streets and Campbell and Western Avenues, to South Fortieth Avenue, and its Garfield Park branch at Forty-Eighth Avenue to Fifty-Second Avenue. The ordinance requires the company to proceed to the purchase or acquisition of a right of way within sixty days and to have the extensions completed within two years. A bond of $50,000 is required.

INDIANAPOLIS, IND.—The Indianapolis & Greenwood Electric Railway Company and the Indianapolis Electric Railway Company have reached an understanding in regard to the operation of the former company's cars over the lines of the latter company in the city proper, and a contract will be signed shortly. The franchise is for twenty years. The Greenwood Company is to pay the city $100 for every passenger car that is used regularly on the streets and $50 a year for every combination freight and passenger car. Fare is to be the same as that collected by the Indianapolis Street Railway, but no transfers will be granted. The Board of Works reserved the right to require transfers at the end of five years. Interurban cars are to stop at all crossings if passengers want to get on or off. The Greenwood Company objected to being required to maintain a warehouse, but the Board stood by the proposition. The Board will require that large freight be put off at the Belt Railway. The Greenwood Company will run cars west of Maryland Street, but will be allowed to use Washington Street as they leave the city.

AUGUSTA, MAINE.—Crescent Park, on the line of the Augusta, Hallowell & Gardiner Railroad, at Farmingdale, has just been opened to the public. It has been the aim of the landscape gardener who laid the park out to make the park rustic in appearance and to maintain its natural beauty. A dam has been built in a gully in the park, and the banks around the pond rise to a height of 50 ft. A rustic bridge has been built to span this stream and make a very pretty decoration. The park is lighted with electricity and the walks are covered with gravel. A stand has been erected on the banks of the river and from this band concerts are given.

MEDFIELD, MASS.—The Medfield & Medway Street Railway Company held a public opening of its line between Medfield, Medway and Franklin Center, June 27. In response to invitations of H. Gore & Company, of Boston, the contractors and builders, three special cars filled with street railway men, town and county officers, citizens and newspaper men, left Dedham at 12:15 over the Norfolk Western Street Railway. The run was all the way through a beautiful rural district, and covered sections of Dedham, Westwood, Dover, Walpole, Medfield, Millis, Medway and Franklin. The party was in charge of Edward S. Spring, superintendent of the road. The new road is 4 miles in length. The total cost of construction was about $240,000. Brill, Laconia and Newburyport cars are used. The car house, waiting-room and storage-battery buildings are located at Pond Plain, in Westwood.

TEMPLETON, MASS.—The Templeton Street Railway Company expects to have its new line ready for operation by Aug. 1. It was originally planned to have the line in operation by June 1, but unavoidable delays were encountered.

BOSTON, MASS.—A broken brake-chain on an inward bound car of the Boston Elevated Railway Company from Brookline to East Boston caused the car to jump the track at Roxbury Crossing, on Tremont Street, June 29, and dash into a house. Twenty persons were injured.

BAY CITY, MICH.—The Bay Cities Consolidated Railway Company has worked a complete transformation at Wenona Beach since the first of last month, and with the exception of the bath and boat-houses there is little left to identify the old place. The peanut stands have been remodeled and moved from their former sites and now occupy a row along the main entrance to the grounds. The café is an open building, fitted with electric lights and chairs and tables. A broad and very substantial sidewalk has been built to the boat and bath-houses and the walks around them widened. A number of cottages have been moved away and arrangements will be made for moving the remainder. The site of the old pavilion has been graded and a large portion of it sodded, while the remainder was filled with black earth and planted with flowers. Broad cinder walks start from the entrance of the grounds and connect the various buildings. The trees and bushes throughout the place have been trimmed, the grass cut, and everything is fast being made to look as neat as a pin. All the buildings have been painted white.

KANSAS CITY, MO.—The Kansas City, Liberty & Excelsior Railway Company has been incorporated, with a capital stock of $1,000,000, to construct a railway from a point in Clay County opposite Kansas City, Mo., through the town of Liberty to Excelsior Springs, on the eastern line of Clay County, a distance of 30 miles. The motive power of the road is not specified. Claud Hardwick, Charles H. Scott and Riley Bevins are among the incorporators of the company.

ST. LOUIS, MO.—The St. Louis County Court has granted the Wellston, Creve Cœur Lake & St. Charles Railway Company a franchise to construct an electric railway, which will connect with four steam railways and four other electric lines. The franchise designates a route beginning at Carsonville, where the St. Louis & St. Charles Electric Road connects with the St. Louis & Suburban, thence running along the Natural Bridge Road to a point of intersection with the St. Charles Rock road and going through Bridgeton. Another branch commences at the Missouri River, near the Burlington Railroad bridge, thence traverses southward through Crosskeys and Florissant, connecting there with the St. Louis & Suburban Railroad. From Florissant it continues southward to the crossing of the Wabash Railroad at Bridgeton; goes through Bridgeton and Palonville, connecting with the Midland Railroad. Extending southward, it enters the town of Mokeville and connects with the St. Louis, Kansas City & Colorado Railroad. Crossing this, the proposed line continues to Stephen's Grove, at Creve Cœur Lake. The entire line is to be constructed on a private right of way. The court provided that at the crossing of highways no more than 200 ft. of them be traversed. Ninety days was given the company to file a bond of $5,000 to guarantee compliance with the provisions of the franchise.

ST. LOUIS, MO.—An ordinance has been introduced into the City Council by the St. Louis Transit Company asking for permission to tear up some of

its tracks in the vicinity of the Fair Grounds and substitute a loop for lines centering there.

ST. LOUIS, MO.—The employees of the St. Louis & Suburban Railway Company are to have a club-room furnished and maintained by the company. The auditorium at 3919 Morgan Street is the place selected by Manager Jenkins. A pleasant feature of the innovation is that all reliefs of train crews will be made from the club-house, instead of at Sarah Street as heretofore. Baths are to be provided at the quarters, where the men can get rid of the heat and dust of their work when their runs for the day are over.

KANSAS CITY, MO.—During the Democratic National Convention, held here last week, the Metropolitan Street Railway Company maintained two information bureaus for the convenience of the delegates to the convention. The bureaus were in charge of men thoroughly familiar with the city and its surroundings, and were of great convenience to the visitors.

NASHUA, N. H.—Two cars of the Nashua Street Railway collided a few days ago. Several passengers were injured and one had her leg broken.

DUNKIRK, N. Y.—The Dunkirk & Point Gratiot Traction Company has completed and placed in operation its line between Dunkirk and Point Gratiot. The company is at present operating seven cars. The officers of the company are: L. F. Stearns, president; J. C. Haggett, vice-president and general manager; George A. Starr, secretary; A. J. Lenet, treasurer; L. F. Stearns, J. C. Haggett, Wm. Bookstaver, M. L. Hinman, E. R. Warner, A. J. Lenet, J. C. Karney, A. H. Marsh and S. F. Nixon, directors.

SYRACUSE, N. Y.—The Syracuse, Lakeside & Baldwinsville Railway Company has satisfactorily settled the difficulty between it and the village of Baldwinsville, and the tracks are being extended across the Seneca River and through Canal Street to the Delaware, Lackawanna & Western tracks in that village, thus completing the road under the terms of the franchise.

POUGHKEEPSIE, N. Y.—The village of Wappinger's Falls has begun action against the Poughkeepsie City & Wappinger's Falls Electric Railway Company to have the franchise granted the company in Wappinger's Falls vacated. The franchises were given seven years ago. Only the line to Poughkeepsie was built and operated. The village seeks to compel the forfeiture of the franchise for the other lines, on the ground of "non-user." The company seeks to hold the franchises on the ground that no public interest is affected thereby. If they are permitted to lapse there would be a loss, for since they were granted in 1893 the State Legislature has enacted a law prohibiting the granting of any further franchises for the construction of railroads in the old Boston Post Road. The company asserts that conditions of traffic do not warrant the building of the lines at present.

ROME, N. Y.—The Rome City Street Railway Company has placed an order with the Compressed Air Company, of New York, for the equipment of fifteen of its cars with the new type air motor.

BROOKLYN, N. Y.—It is said that the Brooklyn Rapid Transit Company has decided not to take to the Court of Appeals the right to charge 10 cents to Coney Island, provided a decision can be had on that question in the Appellate Division of the Supreme Court sitting in Brooklyn. This may put an end to McNulty's suit through the State Attorney-General to take away the franchise of the roads.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company has arranged to reduce the number of trips on all the lines, except those running to the seashore. Cars will run just as frequently during the rush hours, however, the reduction only operating during the middle of the day and late at night.

SYRACUSE, N. Y.—The valuation of the franchises of the Syracuse Rapid Transit Railway Company has been placed at $1,262,000 by the State Tax Commission.

NEW YORK, N. Y.—Commissioner Shea, of the Department of Bridges, has reported to the Mayor that the receipts of the Brooklyn Bridge for the year ending Dec. 31, 1899, were $435,208.76, and expenditures $284,507.19, leaving a profit of $150,701.57. The electric and elevated companies paid $159,593.30 for the privilege of running cars on the structure.

BINGHAMTON, N. Y.—The Stowe Driving Park, in this city, has been purchased by the Binghamton Street Railroad Company backed by New York capitalists. The property brought $22,617.

BUFFALO, N. Y.—The International Traction Company contemplates making a number of important improvements in its park at Olcott, and has plans for remodeling the grounds, drawn by Frank M. Blaisdell, of Boston, who laid out Norumbega Park at Boston, and Merrymeeting Park at Brunswick, Maine. The plans for the improvements of the park are elaborate. All of the buildings will be of rustic design. The principal building outside of the hotel will be a theater. The auditorium will be covered in for the protection of the audience, and the stage will be open to the sunlight. Nature will supply the scenery. The lake and the grove will be in plain view of the audience, and this feature will also allow of free ventilation and comfort. J. W. Gorman, of Boston, will furnish the attractions at the theater, and a new cast will be presented each week. The present hotel on the grounds will be enlarged and greatly improved and made to conform with the rustic surroundings. The hotel is of brick, but the new addition will be a frame structure and will extend to the lake. One of the largest buildings will be the pavilion, which will be 200 ft. long. In it will be a dance hall, a restaurant and a shelter building combined. It will be provided with open sides fitted with slide windows, which will afford protection in rough weather. There will be bath houses, toboggan slides, boat houses and merry-go-rounds galore, and all the features of a summer resort will be found. One of the contemplated improvements to the grove is the erection of a sea wall for the protection of the grove and the beach. It will be built of cement and will be 8 ft. high. A dock will be built out into the lake, so that boats can land and swimming and fishing be enjoyed from it. Mr. Ely said during the course of the interview that eventually the company would make an effort to have a lake excursion boat line touch at Olcott.

STATEN ISLAND, N. Y.—The waiting-room and transfer station of the Midland Electric Railway Company at Concord was destroyed by fire July 2. The loss was between $3,000 and $4,000.

LONG ISLAND CITY, N. Y.—The New York & Nassau County Railway Company, which was incorporated early this year to construct an electric railway from Queens Borough line near Queens to Hempstead, has elected the following officers: Joseph Bermel, president; P. J. Marra, vice-president; E. J. McKeever, treasurer; W. L. Woodill, secretary. The directors have adopted a resolution requesting the State Board of Railroad Commissioners to set a date for a hearing upon an application for permission to build the road.

ZANESVILLE, OHIO.—The Zanesville Electric Railway Company has awarded prizes to the motormen and conductors who have had no accidents during the past six months. Thirteen men secured prizes. Ten dollars was given to the motormen and five dollars to the conductors.

COLUMBUS, OHIO.—The Council has passed an ordinance granting the Grove City & Green Lawn Street Railway a franchise for the construction of electric lines on Mound and McDowell Streets to connect with the lines of the Columbus, London & Springfield Railway Company. This gives the Grove City & Green Lawn entrance to the heart of the city.

COLUMBUS, OHIO.—The Columbus, London & Springfield Traction Company has filed its acceptance of the ordinance granting the company a franchise over the National Pike. The company paid $2,500 for the grant, and has deposited $5,000 to insure the construction of the road. The franchise is for a period of twenty-five years. Active preparations are being made to begin the construction of the road at once, and ties are being distributed along the route.

MARIETTA, OHIO.—The City Council has passed an ordinance granting the Marietta Electric Company a franchise for the extension of its line (known as Route 2) upon the county road known as Green's Road, from the easterly corporation line of Marietta to the northerly end of Duck Creek Bridge. The grant is for a term of twenty-five years, and will be subject to the terms and conditions contained in the ordinance establishing Route 2.

DAYTON, OHIO.—Local authorities have commenced proceedings to force the Southern Ohio Traction Company and the Dayton, Springfield & Urbana Electric Railway Company to put safety fenders on all cars operated within the city.

CHILLICOTHE, OHIO.—The Chillicothe Electric Railroad, Light & Power Company has removed its office to No. 22 West Second Street.

WORCESTER, MASS.—Opposition to the construction of the Worcester, Leominster & Fitchburg Street Railway Company appears to have disappeared, and the company is now preparing to present applications for franchises in Worcester, West Boylston, Sterling and Leominster.

COLUMBUS, OHIO.—The street railway employees here are donating 25 cents each per month to be distributed to the city poor at Christmas time.

SALEM, OHIO.—The reported sale of the Alliance Gas & Electric Light Company, the Alliance and Salem street railways and the franchise for the Alliance-Salem Road, to an Eastern syndicate is denied by officials of the companies.

CINCINNATI, OHIO.—The Millcreek Valley Street Railway Company has placed an order for twenty cars with the St. Louis Car Company.

POTTSVILLE, PA.—Two cars of the Pottsville Union Traction Company collided between Schuylkill Haven and Adamsdale on July 5. Twenty passengers were injured by the collision.

WILKESBARRE, PA.—On July 8 two cars on the Duryea & Scranton line collided, one man being killed and ten injured. The dead man was a motorman of one of the cars, who heroically remained at his post in an endeavor to stop the car, and was crushed. The accident is said to have been caused by a switch which had been mislaid by some boys.

HARRISBURG, PA.—The annual meeting of the Harrisburg Traction Company will be held July 17. The most important matter to come up at this meeting will be the reports of the year and the election of a board of directors.

PHILADELPHIA, PA.—The Philadelphia *Financial News* gives the following list of properties acquired or shortly to be taken over by the Consolidated Electric Company: Kennett Electric Light, Heat & Power Company, Kennett Square, Pa.; Haverford Electric Light Company, Haverford, Pa.; Oil City Electric Company, Oil City, Pa.; Franklin Electric Company, Franklin, Pa.; Franklin Gas Company, Franklin, Pa.; Titusville Electric Light & Power Company, Titusville, Pa.; Armstrong Electric Company, Kittaning, Pa., Kittaning & Ford City Street Railway Company, Kittaning, Pa. On Aug. 1 the Consolidated Electric Company will operate the following additional properties: Wayne Electric Light Company, Wayne, Pa.; Coatesville Electric Light, Heat & Power Company, Coatesville, Pa.; Doylestown Electric Company, Doylestown, Pa.; Doylestown Gas Company, Doylestown, Pa.; Bristol Electric Light & Power Company, Bristol, Pa.; Bradford Electric Light & Power Company, Bradford, Pa.; Warren Electric Light Company, Warren, Pa.; Warren Gas Light Company, Warren, Pa.; United Light Company, Uniontown, Pa.; Steubenville Gas & Electric Company, Steubenville, Ohio; Steubenville Traction Company, Steubenville, Pa. The Consolidated Electric Company was organized under the laws of New Jersey a few months ago, with an organized capital stock of $4,000,000. The officers of the company are: William F. Eidell, president; Stanley R. Ketcham, vice-president; C. E. Gouert, secretary; Charles F. Lamb, treasurer.

CHATTANOOGA, TENN.—The Chattanooga Electric Railway Company and the Chattanooga, Rome & Southern Railroad have entered into an agreement by which cars of the former will be run over the lines of the latter to Chickamauga Park.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

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Organization of the New England Street Railway Club

A number of street railway superintendents, as well as others interested in street railways, was held on Wednesday evening, July 18, 1900, at Young's Hotel, Boston, to discuss the arrangements for an outing some time during the month of September, to include all who are in any way interested in street railways, taking in all the New England States. There seemed to be a general feeling among the superintendents that such an outing would be a grand success, and of much mutual benefit, if all would take an interest in it. The meeting was a most enjoyable affair. There were about thirty-five gentlemen present, and it was decided to form the "New England Street Railway Club," the membership of which would be composed not only of operating railway men, but of all persons interested in street railway work. The following officers were elected: President, H. E. Bradford, Marlborough Street Railway Company, Marlborough, Mass.; vice-president, L. H. McLain, Newton & Boston Street Railway Company, Newtonville, Mass.; secretary, R. H. Derrah, Boston, Mass.; treasurer, George H. Burgess, Leominster & Clinton Street Railway Company, Leominster, Mass. The executive committee consists of the officers and F. G. L. Henderson, Newton Street Railway Company, Newton, Mass.; E. E. Potter, Union Street Railway Company, New Bedford, Mass.; J. F. Whetles, Boston, Mass.; W. G. Meloon, Portsmouth; Kittery & York Street Railway, Portsmouth, N. H., and D. F. Burritt, Palmer & Munson Street Railwaypany, Palmer, Mass.

As the club is formed for social purposes only, it will be quite distinct from the Massachusetts Street Railway Association, and will not interfere with the latter in any way. A meeting of the club will probably be held within a month to arrange for an outing some time during September.

Terrible Accident at Tacoma

An accident, worse than the Pecks Mills disaster of last summer, and probably the worst in the history of electric railroading, occurred at Tacoma, Wash., on July 4. A car crowded with passengers from South Tacoma and Spanaway Lake jumped the track at a high bridge crossing a gulch at Dehn and D Streets, falling a distance of 100 ft., and striking on its roof. The heavy motors and trucks crashed through the floor of the car, killing thirty-six persons and injuring about sixty. Other passengers would probably have suffered similar fate had they not jumped from the car when they saw that an accident was not to be averted.

The Chicago Street Railway Commission Recommends a Modified Form of Municipal Ownership

The Railway Committee of the City Council has declared in favor of a modified form of municipal ownership of street railways, and in favor of a form of compulsory arbitration in labor disputes, which would make street railway strikes impossible. The commission agrees that street railway strikes are such an interference with public business that the municipality is justified in taking steps to prevent them. While no plan was selected formally, the opinion was that all grants of franchises should have a clause providing for compulsory arbitration. The commission committed itself to municipal ownership so far as the tracks and other parts of a street railway plant actually in and a part of the street are concerned. It did not decide in favor of municipal ownership of rolling stock, power houses and other parts of the plants, and municipal operation was not considered at all.

Fourth of July Traffic and Accidents

July 4 was, according to the traffic figure kept by the street railway companies in the larger cities, a record breaking day in the number of passengers carried. Companies all over the country enjoyed a large increase in traffic, and former records for carrying passengers were broken in many cities, including Albany, Troy, Kansas City and Buffalo. The day was also eventful in the way of accidents, the worst of which occurred at Tacoma, where thirty-six persons were killed, and about sixty injured, and at Webster, Mass., where two were killed and many injured. Accidents not so grave as those mentioned above occurred at Dayton, Cincinnati, Detroit and Kansas City.

The Situation in St. Louis

The strike situation at St. Louis remains unchanged. The company is operating its cars regularly, and but for the appearance of the 'buses, run by the strikers, there is no indication that a strike is on. So far there have been very few attempts at violence. One man was killed, however, by an employee of the Transit Company,

whom he attacked on Saturday, and another was seriously injured. On July 17 the citizens' arbitration committee sent letters to President Whitaker and the directors of the company and Chairman T. S. Edwards, of the grievance committee, formally requesting that they submit the differences between the company and the strikers to arbitration.

Besides the difficulties with its employees the company has also to prepare to defend quo warranto proceedings against it by the Attorney-General, who prays for the revocal of the charters of the St. Louis Transit Company, United Railways Company and the National Railway Company, on the ground that the United Railways Company has not conformed with its charter and that it is a party to a scheme to create a street railway monopoly in St. Louis, as shown by its lease of its properties to the St. Louis Transit Company, a corporation apparently formed to assist in the formation of the alleged monopoly. The petition alleges over-capitalization and violation of the State and Federal constitutions.

Mr. Louderbach Resigns from the Lake Street and Northwestern Elevated Roads of Chicago

D. H. Louderbach resigned last week as president and director of both the Lake Street Elevated Railroad and the Northwestern Elevated Railroad, of Chicago. Howard Abel, secretary and treasurer of the Lake Street Elevated Railroad, was elected president of that company, and Harvey T. Weeks was elected to succeed him on the board. William V. Griffin succeeds Mr. Abel as secretary and treasurer of the company. Louis S. Owsley has been elected president of the Northwestern Elevated, to succeed Mr. Louderbach. Mr. Abel is considered to be well qualified to perform the duties of his new position, he having been connected with the Northwestern Elevated, the Union Elevated and many of the surface lines now embraced in the Consolidated Traction Company, and also having a prominent position in the management of the Lake Street Elevated during Mr. Louderbach's term as president. Mr. Abel is thirty-two years old. Mr. Owsley's experience began several years ago as treasurer of the West Chicago Street Railroad. He is thirty years old.

Superintendent Rounds of the Metropolitan Street Railway Resigns

Frederick D. Rounds, general superintendent of the Metropolitan Street Railway Company, and general manager of the Third Avenue Railroad Company, of New York, has resigned. Mr. Rounds' resignation is said to have been due to marital troubles, and it is announced that he will leave the city and embark on a business career elsewhere. Mr. Rounds was born in Watertown, N. Y., in 1864, and came to New York twelve years ago. He became interested in the work of the Young Men's Christian Association, and was later elected secretary of the West Side branch of that association. Later he became secretary of the Broadway & Seventh Avenue Railroad. When Mr. Vreeland was elected president of the Metropolitan Street Railway Company in 1893 he appointed Mr. Rounds as his secretary. Through perseverance and attention to duties he was gradually advanced to the position which he has just resigned. The position held by Mr. Rounds has been abolished, and the duties will hereafter be performed by Oren Root, Jr., the present assistant general manger. T. A. Delaney, who was superintendent of the Second Avenue division of the Metropolitan system, has been advanced to the newly created position of superintendent of transportation. J. J. Shea, who was Mr. Delaney's assistant, has been elected to succeed Mr. Delaney.

New York Roads to Fight the Franchise Tax Law

The railroads of New York City are preparing to fight the franchise tax law, and have secured writs of certiorari against the State Board of Tax Commissioners to review the assessments made for this year under the new law. In each case it is set up that the assessments are wholly illegal, the contention being that the franchise tax law impairs the obligations of the contracts under which the franchises were acquired and so is in contravention of the State and federal constitutions. The writs are all returnable the first Monday of October.

The Third Avenue Railroad Company was first assessed by the State Board at a valuation of $11,886,200. On aplication for a correction of the assessment it was reduced to $11,247,712. Aside from the constitutional question raised it is contended that the assessment is based on an overvaluation of $10,483,878.

The Forty-Second Street, Manhattanville & St. Nicholas Avenue Railway Company was assessed at $2,418,900, but the State Board reduced this on a hearing to $2,047,149. The company says the reduced assessment is too high by $1,577,853.

The assessment of $2,320,000 made against the Union Railway Company (Bronx) was reduced to $1,702,278 by the Tax Board, but the company says this an overvaluation by $1,117,278. The Union Railway Company (Manhattan) was assessed at $50,000, but that was reduced to $46,000. It is urged that the reduction should be to $5,000.

The Dry Dock, East Broadway & Battery Railroad, which got the State Board to reduce its first assessment from $2,708,000 to $1,378,767, wants the valuation put at $100,000. The Southern Boulevard Railroad Company had its assessment of $211,680 reduced to $155,395 by the State Board. It says that this is an overvaluation of $67,395. The Westchester Electric Railway Company was assessed $183,320. This was lowered to $115,800 and the road wants a further decrease to $65,300. The Manhattan Railway tax is based on a valuation of $46,127,000. The company asks for a reduction to $11,720,239.

Employees of the Chicago Union Traction Company Secure an Advance in Wages

On July 10 the Chicago Union Traction Company notified the employees of its North Side lines in an official circular that after Aug. 1 they would be paid by the hour at the same rate now in force on the West Side. No employee will receive less than $1.50 per day. The circular urges the men to stricter attention to their duties to the company and to the public. The circular follows in part:

"Chicago, July 10, 1900.—To the Employees of the Chicago Union Traction Company—Gentlemen: In the management of great interests like the Chicago Union Traction Company, and in order to successfully meet all the requirements of the public, it is necessary that the management and the employees thoroughly understand each other. With this object in view, it is my desire in this communication to call your attention to the many criticisms which are being passed upon your actions, principal among which are the alleged ungentlemanly treatment of passengers and general carelessness which results in accidents.

"Before taking unnecessarily harsh measures it is the desire of the management to better present conditions and also retain the employees who are now in its service; therefore I especially and most earnestly request that conductors, gripmen, motormen and all other employees so conduct themselves in every act that their conduct toward the public may be such that it will commend both the employees and the management to the entire community. In other words, an employee of this company must be a gentleman under any and all circumstances.

"In reference to accidents, I wish to say that there are conductors, gripmen and motormen who have been in the service of this company for a number of years, and have never had a serious accident, at the same time running upon streets where others meet constantly with annoying and expensive accidents, caused by lack of attention and forethought to see impending danger.

"I wish to state most emphatically that avoidable accidents must be stopped. I am of the opinion that this can be brought about without the dismissal of men, and call upon you to demonstrate, by your actions, commencing this day, that accidents may be materially reduced. If this cannot be accomplished by mild measures, the management will be forced to act more severely.

"Be gentlemanly at all times. Remember that deportment is considered in the general standing of an employee, and neatness of person and attire is as much necessary to success in the railroad business as elsewhere. Elderly persons and women with children should have assistance when getting on or off your car. Remember that in the railroad business, as well as elsewhere, gentlemanly deportment, neatness of person, and good common sense will sooner or later meet with their proper reward.

"As further evidence of the close relations existing between employer and employee, the management has concluded (at a time when no demands are being made) to pay all trainmen in the service of the Union Traction Company a uniform rate by the hour. On and after the first day of August, 1900, the employees of that part of the system known as the old North Chicago Street Railroad will, if they prefer this system of payment, receive the same rate of wages as now paid to those of the West Side lines of this company, as follows: Gripmen, 23 cents per hour; motormen, 21 cents per hour; cable grip-car conductors, 23 cents per hour; cable trailers and electric car conductors, 21 cents per hour.

Yours very truly,

J. M. Roach,

"President and General Manager."

The Berlin Street Railway Strike

[*From Our Regular German Correspondent.*]

The strike which occurred recently on the lines of the Grosse Berliner Strassenbahn, though of shorter duration than that in St. Louis, seriously crippled the service of the company while it lasted. Of the 5200 employees of the company, 4800 went out. Soon after the ordering of the strike, on May 18, the former employees and their sympathizers commenced their interference with the operation of the company's cars. Numerous attempts at violence are reported and the strikers resorted to the most cowardly means to do damage to the company's property and injure its new employees. These latter soon refused to do their duties, as they were no longer certain of their lives, but as soon as operations were stopped, there were no more demonstrations by the mob. The officials of the company announced their position in a circular, which was sent to the press, and which contained the following statements:

"While the directors of the road attempted to continue the operation of the road in the best possible manner with new men the strikers endangered the lives of these men by systematic attacks, and interfered with traffic by damaging the company's property, placing stones on the tracks, and unharnessing the horses. This plainly shows that the leaders of the strike have no intention of arriving at an amicable settlement with the officers of the company, but are desirous of forcing matters to extremes by violent attacks without regard to the lives and convenience of the traveling public. The directors, on the other hand, have concluded to meet the demands of the strikers in a peaceful manner. They have promised to pay the motormen and conductors M. 90 per month when they enter their employ. These wages are gradually increased during the first ten years to M.110, and as the men continue in the company's service to M.120. This is in addition to all extra earnings, giving them their uniforms free, promising them a Christmas present, trip tickets and money in case of sickness. The questions regarding the number of working hours and division of time were also discussed with the representatives of the employees, and here again the company met the demands of the men. It should be stated in particular that each man was to get off one day in each week, and one Sunday in each month, and full pay was to be given during vacation days to all men who had served for three years."

It is to be regretted that the principal Berlin newspapers took so adverse a stand toward the company, which does not seem to be liked any too well by the general public. But this is the case with nearly every large railway company, no matter how well it tries to serve the public. The papers, for example, resented the statement of the company that the strikers used extreme measures to force the issue, and expressed the belief that the sympathizers of the strikers should be blamed for the damage inflicted. It seems certain, neverthless, that it must have been the strikers themselves, as familiarity was shown with car construction and equipment by the way in which the cars were dismantled and the brakes, the contact switches, controllers, etc., removed. Even if the strikers did not actually do this destructive work themselves they certainly must have instructed their accomplices.

It may further be remarked that the police were very slow in making their appearance and protecting life and property. In one of the conferences held between the police commissioners and the directors of the company, in the presence of a member of the imperial railway ministry, to discuss the question whether the company had done everything in its power to avert the strike, and what might be expected from a large railway company, it was decided in the affirmative, and the concessions made by the company were deemed sufficient, such as the payment of 40 pfg. per hour overtime, instead of 25 pfg., as heretofore, and this was increased to 50 pfg. per hour by the directors, thus doubling the former rate.

The magistrate also had a conference with the city's traffic association to discuss the question of the pensioning of old, incapacitated street railway employees. The company, it should be stated, is about to establish a pension fund for all its employees, to which the latter and the directors contribute equally. The employees have their dues deducted from their monthly salaries, while the directors contribute their share at the end of the fiscal year. The question at issue now is as to who is to decide when an employee is entitled to a pension on account of disability. The directors claim this right for themselves, while the employees assert that they should have a right to share in this decision, because they contribute equal dues. The magistrate agreed with the employees, and this latest demand has been submitted to the company, namely, that the board of trustees of the pension fund shall be composed of delegates chosen by the employees and by the directors, who shall decide the question of eligibility to a pension.

The strikers chose this time for making their demands, as they knew the density of the traffic during the pfingst holidays, and the loss a strike would mean to the company during that time.

On Sunday, May 20, traffic was resumed with sixty cars, and was continued on seven main lines, until 7 p. m. The employees consisted of men who had stood by the company, and new hands which applied in very large numbers. Each motorman was accompanied by a guard, and ample preparations had been made by the police to avert any violence on the part of the strikers. The latter left Berlin during the early morning hours, and assembled in the suburban towns.

The demands of the strikers were as follows: Conductors and motormen to start with wages of M.90 a month, which is to be increased M.5 each year until a maximum of M.130 is reached, that is after eight years of service. A working day to consist of nine hours for motormen, of which only eight and one-quarter should be working hours, there being one or two periods of rest, three-quarters of an hour in length. No trip should take longer than one and one-half hours, and after each trip there should be a rest of at least twelve minutes at the terminal points. Should the men demand extra pay on Sundays or other days with heavy traffic, the rate shall be 60 pfg. per hour. The conductors demand ten working hours and the same maximum hours and other conditions asked for by the motormen. The latter shall be permitted to draw mileage (trip money) as they did formerly, which amounts to about M.15 each month, while the conductors shall be permitted to receive tips. Conductors and motormen are to receive ten days vacation each year, and one day off duty each week, which must be a Sunday once every four weeks. All these "off" days shall be paid for in full. They further demand that a married man must be notified three months in advance if he is to be transferred to another territory, and a single man four weeks in advance. This is demanded because formerly it was often necessary for a man, who had been transferred to a distant portion of the system, to travel an hour or more before he reached his home. The men base their claims for higher wages and shorter hours on the fact that the introduction of electricity demands greater care and attention on the part of the employees, and that the motormen are in constant danger of being imprisoned, the penalty in Germany for a collision. For that reason the motormen are steadfast in their demands. In addition to the above danger they claim that their health and lives are imperiled frequently on account of the reckless driving of coachmen and the high speed of the cars.

This recklessness on the part of the Berlin drivers is evidenced very clearly in the official report of the Traffic Commissioner for 1898. According to these statistics 2517 accidents to persons are due to horse and electric cars, seven of which were fatal, 145 serious and 1048 slight injuries. The omnibus service is responsible for 163 accidents, seven fatal, forty-two serious and seventy-six slight injuries. Other vehicles, such as butcher and beer wagons, caused 2996 accidents, forty-two of which were fatal, 463 serious and 1559 slight injuries. One thousand and ten accidents are due to bicycling, of which two were fatal cases, thirty-eight serious and 497 slight injuries. A total of sixty-six persons were killed in these ways in 1898, and in 1899 seventy-six persons. It must not be forgotten that the streets are wide and well paved, while in other large cities, such as London, Paris, Vienna, etc., the drivers are frequently handicapped. Many attempts have been made to remedy this evil, and it has lately been proposed by Mr. von Ploetz to establish a training school for drivers, which should be supported by the city, and where each newcomer must satisfy the police department that he is capable of managing his team before he is permitted to appear on a seat of a conveyance in the streets of Berlin.

On Monday, May 21, the service was continued in the same manner as on Sunday. On Friday, Saturday and Sunday the strikers had held meetings which were attended by 4000 men, and it was decided to ask the Mayor of Berlin, Mr. Kirschner, to act as arbitrator. The latter accepted the office, and advised the men to go to the directors of the road and ask them to sanction their selection. This was agreed to, and a meeting was held at the City Hall, which lasted until 4:30 p. m. An agreement was finally reached, and the strike was declared off, the following conditions having to be fulfilled:

The pension fund is to be managed by a board consisting of delegates chosen by the employees and directors. The salaries of the motormen and conductors at the beginning to be M.85, after a six months trial M.90, after three years' service M.95, after ten years' service M.100, after fifteen years M.115, and after twenty years M.120. The employees are to get four days off duty each month, and every seventh day must be a Sunday. The maximum number of hours for conductors is eleven, for motormen nine. Overtime is to be paid for at the rate of 50 pfg. per hour. At each depot there will be representatives of the men, who will look after the welfare of the employees and settle any differences which may arise between them and the officials of the company. All these

agreements were ratified by the strikers, and the strike was declared at an end at 3:30 p. m.

As the general public evinced great sympathy with the strikers at the beginning of the disturbance, without having any knowledge of the income of the men and the prevalent conditions, as well as the new arrangements entered into by the employees and the company, it might be well to point out by actual figures how great an influence the moneys paid to employees have on the profits of, and therefore the dividends paid by, the company. The desire for more wages is becoming epidemic throughout Germany, and for that reason this question is one of particular interest and importance.

In looking over the 1899 report of the company we find the following items in the chapter dealing with salaries: Five thousand three hundred and fifty-seven persons were employed, against 5014 in 1898. The increase of 343 persons is due to the extensions of the electric roads.

1. The wages of these 5357 employees during 1899.....	M.5,136,908
2. For work on extensions, including the care of depots, roads, maintenance of horses and wagons, etc.	913,455
3. Payment for living quarters for watchmen and depot master	11,325
4. Uniforms supplied free to the men and their repairs	223,469
5. For sick and disabled employees.....	42,555
(To sick persons the sick fund pays two-thirds of their salary, and if they have been in the service of the company for three years, the latter adds the other third; this amounted to 38,000 marks, which is included in the above item.)	
6. At the general meeting there was allowed for aid to employees.....	50,000
7. The company paid into the sick fund.....	45,200
8. The company paid into the treasury of the accident insurance company for the benefit of the employees.	29,000
9. For insurance of old and crippled employees.....	41,000
Total	M.6,493,307

This gives an average income for each man of M.1212.11 or M.101 each month, which cannot be considered as insufficient or starvation wages, in view of German conditions. Besides their wages, the conductors, and to a lesser degree, the motormen, have a small income in the way of tips, which ought not to be omitted from consideration simply because it does not come from the company. The latter could easily charge from 5 to 10 pfg. for each basket or package if it would so elect, instead of permitting the conductors to pocket such fees. It is difficult, however, to estimate this income because the employees are apt to underestimate it when asked for a report. It might be fair to assume that each tenth passenger gives the conductor a 5-pfg. tip. In 1899, 180,000,000 persons were carried on the lines of the Grosse Berliner Strassenbahn; a tenth of this would give 18,000,000 5-pfg. pieces, or M.900,000. This is divided among the 1688 conductors, who give some to the nineteen chief conductors and 1558 motormen, a total of 3265. This would give each man M.275.65, which, added to the above average of M.1212.11, gives a total yearly income of M.1487.76. The beginners, of course, have less income, but in time it reaches this sum. Thousands and tens of thousands of Berlin workmen have less income than this, and many of those who do receive it do not have steady work,—surely not a life job, as is that of the railway employees. It is hard, therefore, to find a real cause for striking, but let us look at the new conditions.

The wages at the beginning have been increased from M.80 to M.85; after six months this is raised to M.90, etc., as stated before, until a maximum of M.120 is reached after twenty years' service. The former maximum was M.100 per month. The switchmen, roadmen, car cleaners, stablemen, etc., receiveM.3, and after some service M.4 per day. The "Kilometer money" of 50 pfg. per day for electric and 35 pfg. for horse service remain as before. Hours utilized for instructing the men are reckoned as overtime. Any employee pressed into military service for practice work will receive full pay.

The increased cost of the service to the company over what formerly obtained, consists of:

1. The increase of wages of from M.5 to M.20.

2. The shortening of the working day by two hours. This necessitates an increase of the force.

3. The establishment of the pension fund. This expense will probably not be less than M.50,000 each year to the company; in 1899 claims amounting to M.100,000 were submitted.

Summing these items up, we find that the salary increase for 3265 men amounts to M.489,750 each year. Adding to this an increase of M.30,000 for the other employees, there is a total increase of about M.520,000 in wages account. The shortening of hours will probably mean a 10 per cent increase in the number of men employed, or about 400 men, at M 1600 a year, making a total of M.640,000. The amount paid into the pension fund might be estimated at M.50,000 per year.

These three items give a yearly increase of M.1,010,000. The company's estimate was about M.1,000,000, showing the above calculation to be about correct.

The company's balance sheet showed a profit to be divided among stockholders of M.4,646,250, or for 44,250,000 shares, a dividend of 10.5 per cent. Subtracting from this the million mark increase in salary, there will be M.3,646,250 to be divided next year.

But in addition to this, the city, in lieu of extending the franchise until 1945, has asked for additional payment from the company. In 1899 the latter paid M.1,656,434, but in the future M.2,000,000 will hardly be sufficient. It is possible that the increased traffic and the cheaper electric service will more than make up for this increase, though this seems doubtful. Besides, the capital was increased last November by M.22,875,000, so that the profits must be divided among M.67,125,000 instead of M.44,250,000. The above M.3,646,250 would thus only produce a 5.43 per cent, instead of a 10.5 per cent, dividend. In fact, large dividends are a thing of the past; from 1890-1895 a dividend of 12.5 per cent was paid, then 15 to 16 and 18 per cent. In 1899 it was 10.5, the lowest in the entire decade. The stockholders have therefore lost over 100 per cent on the exchange, as the shares were formerly worth between 300 and 400, and now are only rated at 227. It is to be hoped, however, that if electricity is introduced on the entire road the showing will be much improved.

On the whole, it may be said that the company easily controlled the strike situation, as cars were run nearly uninterruptedly during the day time, and 22,000 persons applied for work under the old conditions. The victory, however, also is a significant one for the "Social-democracy," which is responsible for the strike. The 4000 employees have now formed an association which is in the hands of social-democratic leaders, and each man pays for social-democratic purposes 20 pfg. per week, or a total for all the men of M.41,600 per year. This may be termed the campaign fund for the next strike.

The success of the Berlin strikers has caused the employees of the Hanover, Cologne and Copenhagen street railway companies to demand higher wages. The Hamburg company had already promised its conductors an increase on April 1, which was a most fortunate circumstance and is probably responsible for the fact that Hamburg, where conditions are similar to those in Berlin, is the only large German city where no strike has taken place. Never before, however, has it been so clearly shown as by this strike how incapable the police force in German cities is to

Test of the Power Plant of the Buffalo Street Railway*

R. C. CARPENTER AND H. J. RYAN

The power plant of the Buffalo Street Railway was tested the latter part of the last term by the department of experimental engineering. The test was made at the request of R. E. Danforth, the superintendent of the Buffalo Railway Company, to ascertain the economy of the station when operating under various conditions. On account of the character of the power available at Buffalo, the test is one of peculiar interest. A large portion of the power is obtained from a steam plant, and a minor part from the water power at Niagara Falls. A storage battery of 272 cells 3000 amp.-hour capacity is also employed to absorb current during the time when the capacity is in excess of the demand and to give out current when the reverse condition exists.

While the plant is not larger in aggregate horse power than others which have been tested at various times by students in the course in mechanical and electrical engineering, yet on account of the number of units and the varied character of the apparatus employed, it required more apparatus and more help to successfully conduct the test than any before undertaken in connection with the Sibley College work.

In order to test the plant under various conditions of operation, it was necessary to operate it continuously for ninety-six hours. This condition made it necessary to have two shifts of observers. In all somewhat over ninety men from the junior and senior classes took part in the various tests as assistants and observers.

In the organization of the test, Professor Carpenter assisted by Professor C. R. Jones and Austin Burt had charge of the mechanical test, including boilers, engines and pumps, and Profes-

* From the *Sibley Journal of Engineering.*

sor Ryan, assisted by E. L. West and G. S. Macomber had charge of the electrical portion of the test. For the purpose of working up results and putting the records of the test in form, the work was divided into three sections and assigned to the following members of the senior class for theses.

1. The boiler section, J. J. Cuyle and L. Morgan.

2. The engine section, Austin Burt, J. V. McAdam, A. Englert, S. E. Smith, C. B. Holden, W. C. Dalzell.

3. The electrical section, G. S. Macomber, Charles R. Scott, R. H. Dearborn, J. M. Gilchrist, G. B. Woodhull, W. L. Cook, J. E. Hess.

The editing of all the mechanical and electrical results was undertaken by Mr. Burt and Mr. Macomber. The other gentlemen devoted their time to the detailed description of special features of the plant and to a discussion of the results.

A considerable portion of this abstract is taken directly from the thesis of Messrs. Macomber and Burt.

OUTLINE OF THE TEST

Equipment—The system of the Buffalo Railway Company is operated under three conditions of power distribution as follows:

1. By steam, operating 10 units, three 1000-hp vertical cross-compound D. C. engines, six 500-hp vertical cross-compound belted engines, one 250-hp horizontal cross-compound Ball engine belted.

2. By Niagara Falls power operating four 500-hp rotary converters.

3. By storage battery operating through a booster.

OBJECT OF THE TEST

The object of the test was to determine the following:

1. The relative value of the three conditions of operation.
2. The economy of the boiler plant.
3. The economy of the engines.
4. The economy of the electrical equipment.
5. The various factors in the operation of the entire plant.

The first it was proposed to accomplish by making three twenty-four-hour runs as follows:

a. Under normal conditions as operated every day, *i. e.*, with full quota of Niagara power, with as many engines as the load required, and with battery in normal service.

b. Eliminating Niagara Falls power and operating with engines and battery alone.

c. Eliminating the battery, operating with engines and Niagara power only.

The second was to be determined by a complete boiler test.

The third, by a complete engine test.

The fourth, by a thorough test of the electrical equipment.

The fifth, to be deduced from the results of the other tests.

The Test as Actually Carried Out—Everything was in readiness and the signal to start the test was given promptly at 11:00 o'clock a. m., Feb. 28, 1900. All went well until about 5:30 p. m., when an unexpected disturbance occurred just at the peak of the load. Owing to the disturbing influence thus introduced it was decided to call this run a preliminary one and make another normal run.

The actual test runs were as follows:

Run "2." Operating under normal conditions.
Run "3." Eliminating Niagara power.
Run "4." Eliminating the battery.

Everything ran along smoothly to the end of the test in spite of the fact that a terrific snow and wind storm prevailed for the greater part of the first three days.

It is a matter for which Sibley College should be congratulated that the largest test, of this character, in the history of engineering was so successfully completed without a single accident, either to the ninety students conducting it or to the valuable machinery so generously placed at their disposal.

The Boiler Plant.—The boiler plant consists of eighteen boilers, two of which are of the Scotch marine type, the remainder are water-tube boilers built by Babcock & Wilcox. The boilers are all set over Roney automatic stokers and are supplied with coal from a traveling car mounted on overhead track. The total boiler horse power has a rated capacity of 5080. The general results of the boiler test are shown in the following tables, each run being twenty-four hours in length:

Pressure	Run 1	Run 2	Run 3	Run 4
Barometer, inches mercury	29.13	28 73	29.08	29.40
Steam gage, pounds	127.5	128 4	128 8	128.7
Absolute steam pressure, lbs	141 75	142 53	143 05	143 1
Draught gage, near damper, inches water	B.67 C.74	B.75 C.65	B.78 C.61	B 75 C.60

Temperature.	Run 1	Run 2	Run 3	Run 4
External air, degrees F	25	22	22 4	26
Boiler room "	90	90	90	90
Escaping gases, "	351 603	333 583	429 608	332 576
Furnace, "	2500	2500	2500	2500
Feed water, "	179 5	180	179	171
Steam, "	353.7	354 2	354.4	355.5

Fuel	
Kind of coal	Bituminous
Locality	West Penn
Size of coal	Run of mine
Fixed carbon, per cent	59.39
Volatile moisture, "	31.75
Moisture, "	1,1
Ash, "	7.76
B. T. U. per pound coal	12800

	Run 1	Run 2	Run 3	Rnn 4
Total coal consumed, pounds	302,742	245,351	354,886	192.262
Total refuse, dry, "	32,860	30,655	43,593	27,871
Total refuse, dry, per cent	10.8	12 5	12 3	14.5
Quality of steam, "	98.66	96.4	98.45	98.3

Total Water.	Run 1	Run 2	Run 3	Run 4
Total wt. water used, pounds	2437.492	1845.184	2742 450	1449.950
Equiv. evap. from and at 212°, pounds	2630.824	1974.433	2954.917	1573.345

Economic Evaporation. Per Pound of Fuel	Run 1	Run 2	Run 3	Run 4
Actual, per lb. dry coal, lbs	8	7.5	7.7	7.5
Equiv. from and at 212° [dry coal] lbs	8.6	8	8.3	8.2
Heat generated per lb. coal	8394	7773	8044	8170
Efficiency of boiler and grate	65.5	61.	62 7	64
Per cent. coal saved by heaters	7.4	8.3	7.2	7.3
Average boiler hp	3178	2410	3570	1900
		5-6 p. m.	9-10 p. m.	6-8 p. m.
} Max. " "		3410	4450	4060
} Rated " "		4340	4840	4840
Feed water from tanks, per cent	88.6	86.1	88.8	86
" " car house drips	0 62	1.0	0.68	1.3
" " low pres. "	9.6	10.7	9.34	9.1
" " high " "	1.18	2.2	1.18	3.6
Steam delivered to engines	94	92	93.5	90
" for heating buildings	1.5	2.3	1.5	3

THE ENGINE SECTION

The engines are numbered consecutively from 2 to 11, as shown by the table. A complete description of the details of the engines may be found in the thesis of Messrs. McAdam and Scott.

The Indicators.—There were thirty-eight indicators in use on the test, four on each engine with the exception of No. 3, which was provided with three-way cocks, and, therefore, with only two indicators. They were for the most part in excellent condition and stood the long strain remarkably well. The reducing motion was of the lever brumbo type and was carefully overhauled and put in good condition for each engine.

The Indicator Cards.—Metallic cards were used exclusively. In all 7344 cards were taken. Sample cards from each engine taken at 6 p. m., March 3, are shown in the thesis of Burt and Macomber.

IHP Data and Results.—The cards were all carefully integrated, computed and checked, and they are tabulated in the Burt-Macomber thesis. A comparative column of ehp with the combined engine and generator efficiency is shown in the same tables.

Table of Averages.—In this table are shown, in the Burt and Macomber thesis, the ihp, ehp, efficiency and r. p. m. averages for each run, together with the actual time the engines are in operation and the total energy in hp-hours developed by each engine.

Table of Totals.—In this table are shown, in the same thesis, the grand total for the three runs.

Table of Summaries.—In this table the average total ihp is derived by dividing the total energy of all of the engines developed by the time the engines are in operation. The total for water evaporated includes the steam used by the auxiliary machinery, but not that used by the heating system, etc.

The Characteristic Curves.—These are shown in the same thesis, and include the actual ihp for each engine and the grand totals.

The Engine Log.—Readings were taken every fifteen minutes, the signals being given as follows:

Three signals—Two minutes before time, to take the r. p. m.

Two signals—One-half minute before time, to get ready.

evaporated includes the steam used by the auxiliary machinery.

One signal—On time to take cards and electrical readings.

The electrical machinery of this plant includes seven 200-kw Edison; six 250-kw Thomson-Houston, and three 800-kw General Electric generators; four 500 kw 25-cycle G. E. rotaries receiving current from Niagara Falls; a 272-cell, 3000 amp.-hour battery capable of being discharged in one hour; and a 3000-amp., 70-volt battery booster, compound wound and motor driven in such a manner as to compensate automatically for the drop due to the internal resistance of the battery causing it to take the station load fluctuations. The normal station bus-bar pressure is 550 volts.

Necessary electrical readings were made to secure the following facts relating to the operation of this power plant:

(1) The load factor of the station, *i. e.*, the ratio of the mean average load for twenty-four hours to the maximum average output, not including fluctuations.

(2) The per centage of variation above and below the average during times of maximum and minimum load on the station, making note at the same time of the probable number of cars in operation from the station.

(3) A daily output curve showing the charge and discharge of the batteries in comparison with the output of the station.

(4) The efficiency of the storage battery, that is, the per centage of energy delivered to the battery in twenty-four hours that is usefully returned.

(5) Regulating curve of the batteries, that is, the voltage during charge and discharge with various currents.

(6) The probable saving in coal consumption due to steadier load obtained by the use of the battery, and the extent to which the battery permits operation of the station with less capacity in generating units than if it were not used.

The output in current and bus-bar pressure of each generator and rotary, and the input of the battery booster were observed each quarter hour on signal at the same moment that the indicator cards were being taken. The battery current was under constant observation; the average current was charted every twenty seconds. The battery pressure was read every five minutes.

The following electric instruments and apparatus belonging to the Sibley College were used in making the above readings and for calibrating available instruments that belong to the power plant:

2 Weston voltmeters, range, 600 volts.
12 Weston millivoltmeters, range, .06 volts.
3 Weston mangain shunts, range, 2,000 amps.
5 " " " " 1,000 "
13 " " " " 500 "

A large number of cast copper connections which were machined to fit the shunt blocks and to connect them to the machinery terminals.

Three sets of No. 10 B. & S. G. 12-ft. connecting wires, and double throw switches for using one millivoltmeter on either of two machines, in three instances.

The voltmeters and millivoltmeters were calibrated in the department of electrical engineering in Sibley College by comparison with a set of Carhart-Clark standard cells. These compariparisons were made by means of a fine Nalder potentiometer and a steady pressure that is furnished over a range of 150 volts by an open circuit battery of 120 cells of the "Badt-Hermetic" type.

The resistances of the shunt blocks were determined by comparing them with a 1000 amp. .0001 ohm Board of Trade standard and a 500-amp. .001 ohm Reichsanstalt standard. The comparisons were made by passing currents from 250 to 1000 amps. through the shunts and reading the falls of potential produced, by means of the millimeters calibrated in the above manner. The current constant for any millivoltmeter combined with any shunt is then quickly determined. Since it is merely necessary to divide the volts per scale division on the millivoltmeter by the resistance of the shunt block and the result will be the constant of the instrument in amperes per division.

In this manner the electrical instruments were calibrated in terms of international volts and amperes with an absolute error not greater than one-fifth of 1 per cent.

The instruments from which the output of the rotaries, the input of the booster motor and the battery current were read belonged to the power plant. These were carefully calibrated by comparison with the Sibley College electrical instruments.

The battery ammeter was of the large Weston illuminated dial, plus and minus scale, pattern. Two observers devoted all their time while on duty to the observation of this instrument. One watched the pointer constantly, and at the end of each twenty second period called out the average value of the current during the third of a minute just past; his colleague charted this reading immediately and gave him the necessary time signals. This was very trying work. The young men were assigned to this duty

Dimensions of Engines

		Eng. No. 2	Eng's Nos. 5, 8, 9, 10, 11, 4	Eng's Nos. 6, 7	Eng. No. 3
Type of Engines		Ball Hor'z. Cr. Comp.	L.E.E.Wks. Vert. Cr. Comp.	L.E.E.Wks. Vert. Cr. Comp.	L.E.E.Wks.* Vert. Cr. Comp.
Nominal hp.		250	500	1000	1050
Nominal r. p. m		225	135	102	100
Hp cyl	Dia.	13"	17"	22"	22"
Lp cyl	Dia.	22"	33"	44"	46"
Stroke	l	16"	28"	36"	36"
Hp piston rod	Dia.	2"	3.5"	4.75"	4.75"
	Area	3 14	9.62	17.73	17.73
Lp piston rod	Dia.	2.5"	3.5"	4.75"	4.75"
	Area	4.91	9.62	17.73	17.73
Hp piston, a = Head end	Area	132.73	226.98	380.13	380.13
Hp piston, a' = Crank end	Area	129.50	217.36	362.40	362 40
Lp piston, a = Head end	Area	380.13	855.30	1520 5	1661 9
Lp piston, a' = Crank end	Area	375.22	845 68	1502 8	1643.2
Lp piston, both ends	Area	755.35	1700.98	3023 3	3306 1
Hp piston, both ends	Area	262.32	444.34	742 53	742.53
Eng. Factor, $K = l \frac{a + a'}{2 \times 33000}$	Hp	.005299	.01571	.03375	.03875
	Lp	.01526	.06014	1.374	1.503

* L. E. E. signifies Lake Erie Engine

Summary of Results of Engine Test

	Run 2	Run 3	Run 4
	Normal	Without Niagara	Without Battery
Total energy developed by engines: hp-hours	65566	107174	52972
Total time engines are in operation: hours	19 95	24.0	18.16
Average total ihp on basis of actual time	3486.9	4465.6	2917.0
Average total ihp on basis of twenty-four hours	2898 9	4465.6	2207.1
Total water evaporated for power only: pounds	1730424.	2612927	1366524
Pounds of steam per ihp per hour, auxiliaries included	24 88	24.88	25.79
Total coal consumed: pounds	245351	354836	192262
Pounds coal per ihp per hour	3.53	3.31	3.64

Engine		Average IHP			Average EHP			Average Mechanical Efficiency		
		Run 2	Run 3	Run 4	Run 2	Run 3	Run 4	Run 2	Run 3	Run 4
Direct Connected	3	978.2	1050.5	915.3	914.0	1008.4	853.7	93.5	95.9	93.2
	6	960.9	999.7	841.6	838.1	856.1	749.3	87.1	85.9	88.7
	7	978.9	1003.0	893.4	813.9	845.3	758.1	83.3	83 3	84 1
		2918.0	3053 2	2650.2	2566.0	2699.8	2361.1	87.9	88.4	87.3
Multi-Polar	5	474.6	464.5	466.6	410.6	396.3	375.7	86.6	85.5	84.2
	8	539 5	527.1	517.9	472.8	450.2	446.1	87 0	85.4	86.2
	9	486.6	507.0	516.9	377.7	408.5	410.5	80 6	80.8	79.5
		1500.7	1498 6	1501.4	1261.1	1255.0	1232.3	83.7	83 9	83.3
Old Bi-Polar	10	429.3	463.9	513.1	364.3	397.2	406.6	85.3	84.6	80.0
	11	517.9	507.4	471.6	440.9	450.1	390.3	85.3	88.6	80.7
	4	392.1	470.9	404.3	302.7	362.4	285.4	74.9	77.3	70.9
	2	....	226.0	301.0	....	171.4	235.0	....	66.0	75 8
		1339.3	1668.2	1690.0	1107.9	1381.1	1317.3	81.8	79.1	76.8
		5 58.0	6220.0	5841.7	4935.0	5335.9	4910.7	84.1	83 7	84.2

Engine		Average R. P. M.			Time in Service—Hours			Energy of Engine—Hp-Hours		
		Run 2	Run 3	Run 4	Run 2	Run 3	Run 4	Run 2	Run 3	Run 4
Direct Connected	3	102.8	101.3	102.7	18.87	24.00	14.48	18,438	25,212	13,253
	6	102.3	100.4	105 1	17.05	15.83	16.57	16,384	15,824	13,946
	7	103.1	96.7	106.5	12.98	19.82	12.55	12,706	12,706	11,212
		------	------	------	48.90	59.65	43.60	47,548	60,917	38,411
Multi-Polar	5	132.1	131.2	132.0	11.82	12.90	6.85	5,609	5,991	3,059
	8	136.2	135.7	135.5	6.27	17.57	5 07	3,383	9,261	2,626
	9	133.7	133.0	134.2	3.98	17.12	4.05	1,865	8,680	2,094
		------	------	------	22.07	47.59	15.97	10,857	23,932	7,779
Old Bi-Polar	10	138.8	137.1	137.3	3.82	12.46	1.52	1,640	5,776	780
	11	140.5	139.0	140.0	13.45	16.68	6.78	6,965	8,463	3,198
	4	141.5	142.0	142.9	6.52	15.55	6.28	2,556	7,322	2,539
	2	------	226.5	225.0	------	3.38	.88	------	764	265
		------	------	------	23.79	48.06	15.46	11,161	22,325	6,782
Total..		------	------	------	94 76	155.30	75.03	69,566	107,174	52,972

for but two hours at a time. The behavior of the battery was thus observed continuously for seventy-two hours.

The results of this test were computed and charted by the following men in the production of their theses: R. H. Dearborn, A. B.; J. M. Gilchrist, C. R. Scott, J. E. Hess, W. L. Cook, C. E.; G. B. Woodhull.

The books that contain the calibration records, and the figures and battery charts constituting the original readings are on file in the department of electrical engineering.

The following tables give the more important results that have thus far been deduced:

ELECTRICAL SUMMARY

Day of 24 Hours	Engine Indicated Hp-hours	Generator Output Hp-hours	Battery Hp-Hours		Rotaries Output Hp-Hours	Total Output E. Hp-Hours Without Rotaries
			Charge	Discharge		
1	------	79,410	7,225	1,487	30.630	73,672
2	69,900	61,300	5,350	1,950	37,500	59,900
3	107,700	92,600	6,100	1 500	------	88,000
4	53,250	46,600	------	------	31,100	46,000

The battery efficiency is not to be determined by taking the ratio of the above discharge to charge hp-hours. An efficiency thus determined would be very unfair for the reason that the above values do not include charges and discharges that occurred within quarter hour periods. These figures do not include momentary charge and discharge energies that occur through the load—regulating duty that the battery performs. The charging values include all the losses incurred through such process and the energy stored for greater periods than one-quarter of an hour. The discharging values include only those discharges of energy that were retained by the battery for one-quarter of an hour or more. To find from these battery values the battery loss incurred in having it carry the momentary station fluctations, the discharge hp hours must be divided by the ordinary battery efficiency, say .75, and the result subtracted from the corresponding hp hours. The result will give the hp hours lost in the battery in taking care of the station fluctuations. Owing to the fact that a battery will carry over energy from one charge to another even when discharged to the same pressure each time it is necessary to determine this regulating cost as an average for the three days during which the battery was under observation.

Total charging hp hours.....18,675
Total discharging hp hours..... 4.937
Average battery regulating cost per day,

$$18{,}675 - \frac{(4937 \div .75)}{3} = 4035 \text{ hp hours.}$$

FUEL CONSUMPTION

Day	Output Elec Hp-Hours Generated. Does not Include Rotaries	Water From and at 212° in lbs. per Elec. Hp-Hour	Coal, Dry, in lbs. per Hp-Hour	Remarks
1	73,672	35.7	4.11	Battery and rotary used
2	57,900	34.1	4.23	Battery and rotary used
3	88,000	33 5	4.04	Battery only used
4	46,000	34.2	4.17	Battery not used

The table above shows only a portion of the saving which is produced by the storage battery. During the entire twenty-four hours, current at the rate of 2000 hp is supplied continuously from Niagara Falls and charged to the railroad company. This current would only in part be utilized during the time when the engines were slightly loaded, as for instance during the period after midnight. The results of test show that the storage battery receives from the Falls power, when the engines are not in use, current sufficient in the aggregate for 3000 hp-hours.* During the operation of the plant the load factor on the engine plant is kept high by stopping any engine just as soon as any evidence of a light load on the station is shown. There are a great number of cars in operation on the various railroad lines, so that the load fluctuations are light, making this practice feasible. This practice insures that under normal working conditions the engines are not operated for any appreciable time with a light load; on the contrary, each is worked within such load limits as to produce little variation in economy. For these reasons the above test cannot be considered as showing what saving might be effected in any station in which the load on the engines has an extreme and wide variation. By comparing the results of the tests on the third and fourth days, which were exactly similar except for the fact that the battery was in use on the third day in connection with the engines, and the engine plant only on the fourth day, it will be noticed that the saving due to use of battery is about 4 per cent. The effect of the battery in preventing fluctuations of the load of small amount and short duration, was quite marked, and aside from the slight saving due to its use, there is doubtless a further saving because of steady load and less repairs to engines.

There are many items of interest in the results obtained from this test that can not be given at this date owing to the large amount of labor involved in their deduction.

* During the period of the test there was a heavy snow fall, making a large night load, which reduced the usual saving due to this cause to 1600-h. hours.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED JULY 10, 1900.

653,218. Motor Controller; D. H. Darrin, Cranford, N. J. App. filed Sept. 2, 1899. With this controller the motor can be stopped at any point short of full speed by breaking the circuit through the manipulation of an extra circuit closer on the handle of the controller and without the necessity of moving the controller handle back to the starting position.

653,316. Trolley; W. H. Russell, Watertown, N. Y. App. filed Nov. 23, 1899. The flanges and tread of the wheel are of hard metal, while the hub, which is not subjected to wear, is of softer metal, the flanges and tread being removable from the limb.

653,402. Safety Trolley; J. W. Richmond, Fishkill-on-the-Hudson, N. Y. App. filed March 28, 1900. Details.

653,441. Grip Mechanism for Cable Railways; J. Craig, Jr., New York, N. Y. App. filed Aug. 4, 1898. This invention relates to that class of grips which are provided with ejectors by which the cable is thrown out of the jaws of the grip, the improvements consisting in certain details of construction.

653,443. Car Brake; R. W. Ennis, Buffalo, New York. App. filed Dec. 27, 1899. Power is applied to the brake shoe from the axle, a clutch being thrown in by the hand lever.

653,522. Car Truck Bearing; F. R. Northan, Chicago, Ill. App. filed Feb. 12, 1900. The object is to provide means for raising the car body to allow for sagging. This is done by making the bearing plate on the truck concave, and that on the body convex, and inserting a concave-convex plate between the two bearings.

653,532. Fastening for Rail Joints; F. W. Schinnel, Portland, Ore. App. filed Dec. 12, 1899. To dispense with nuts in the fastening of fish-plates, the bolts are passed through button-hole slots in the fish-plates.

653,549. Electric Trolley; T. Derrick, Lansingburg, N. Y. App. filed Jan. 27, 1900. Details of a ball bearing.

653,565. Rail Joint; B. O. Ward, of Oak Park, Ill. App. filed Jan. 26, 1900. One of the fish-plates is U-shaped in cross section, and a flange projecting upward from the chair plate rests against it, and is held thereto by bolts, which clamp the parts sufficiently to afford a spring pressure on the nuts.

653,604. Metallic Cross Tie; J. Q. Adams, Manchester, Vt. App. filed March 17, 1900. The tie, at the point where the rail rests upon it, is provided with a socket in which is placed a spring on which the rail rests.

653,634. Apparatus for Automatically Applying Car Brakes; S. F. Woodruff, Clippergap, Cal. App. filed Nov. 11, 1899. A portion of the train pipe is placed within the range of a shearing knife, which cuts it off and allows the air to escape in case the truck runs off the track. The escape of air effects the application of brakes.

11,840. (Reissue.) Contact System for Electric Railways; W. Grunow, Jr., Bridgeport, Conn. App. filed May 29, 1900. This invention covers improvements on prior patent, No. 586,845, and relates particularly to the mounting of an electromagnet which moves bodily when energized to complete the circuit to the working conductor, the current passing through the core of the magnet.

11,841. (Reissue.) Traveling Cable Grip; E. I. Parsons, San Francisco, Cal. App. filed Jan. 30, 1900. The movable jaw of the grip is a nut in which a screw works, the threads of the screw being made rapid, so that a short movement of the crank will set up the jaw.

PERSONAL MENTION

MR. N. E. MORTON, superintendent of the Lawrence division of the Lowell, Lawrence & Haverhill Street Railway Company, of Lowell, Mass., has resigned that office.

MR. D. L. LAVENBERG, formerly chief train dispatcher for the Wheeling & Lake Erie Railroad, has been appointed chief

train dispatcher for the Toledo, Fremont & Norwalk Electric Railway.

MR. J. B. HOGARTH has been appointed auditor of the Denver City Tramway Company. Mr. Hogarth was formerly chief clerk and auditor of the Florence & Cripple Creek Railroad. Mr. Hogarth's fellow-employees on the Florence & Cripple Creek Railroad presented him with a handsome umbrella on his departure.

NEWS NOTES

[News notes for this department are solicited.]

LOS ANGELES, CAL.—The rate war between the Los Angeles Pacific Electric Railway, the Santa Fe and the Southern Pacific to Santa Monica is on in earnest. There is every indication of a big cut in rates in the near future. The electric railway has thus far met the cuts made by the steam roads, and seems to enjoy a large part of the traffic.

BRIDGEPORT, CONN.—Two companies were organized at the offices of Marsh, Merwin & Lemmon, July 12, which, for the near future, at any rate, will be intimately associated with one another. The companies are the Moodus & East Hampton Railway Company and the Mutual Construction Company. The former company was organized for the purpose of building an electric railway to connect East Hampton and Moodus. It will be incorporated under the laws of Connecticut, and the following officers have been elected: F. C. Fowler, of Moodus, president; Clifton J. Harvey, treasurer, and E. C. Crocker, of Bridgeport, secretary; board of directors, F. C. Fowler, Charles E. Brownell, Mr. Chaffee, Clifton J. Harvey, E. C. Crocker, William Markham, E. S. Boyd, A. D. Warner and William A. Redden. The company is capitalized at $150,000, all of which has been subscribed. Of this $15,000 has been paid in. Plans for the work of constructing the road have already been made, and work upon it will be started as soon as the act of incorporation has been passed. All work will be under the supervision of Mr. Crocker, the electrical engineer. As the plans now stand, four gangs, combining about 400 men, will be put to work on four different sections of the road. The Mutual Construction Company will engage in all kinds of construction work. It was capitalized at $10,000, and $2000 has already been paid in. Officers were elected as follows: E. S. Boyd, of Woodbury, president; E. C. Crocker, secretary and treasurer; board of directors, E. S. Boyd, E. C. Crocker, William A. Redden, Clifton J. Harvey and A. D. Warner. It is more than probable that the contract for building the Moodus & East Hampton Railway will be given to the Mutual Construction Company, although no contract has as yet been made.

WILMINGTON, DEL.—At a meeting of the stockholders of the Wilmington & New Castle Electric Railway Company, held July 10, the following directors were elected: Peter J. Ford and Peter L. Cooper, Jr., of Wilmington; K. J. Koch, of Pottstown, Pa.; F. H. Treat, of Wayne, Pa.; R. Steen Martin and C. P. King, of Philadelphia, and Harry A. Richardson, of Dover. Officers were elected as follows: F. H. Treat, president; R. S. Martin, secretary; C. P. Kink, treasurer.

JOLIET, ILL.—The City Council has passed, over Mayor Mount's veto, the ordinance granting the Joliet Railway Company a twenty-year franchise for a double track on its new Chicago-Joliet lines, and a franchise for a line across the new bridge over the drainage canal at Cass Street. Mayor Mount attempted to get clauses inserted providing for a larger compensation, for restriction of the rate of fare, and for other restrictions, but his objections were voted down by the Council.

MACON, ILL.—The Hervey City & Southern Electric Railway Company has been incorporated, with a capital stock of $15,000, to construct an electric railway from Hervey City to Shelbyville. The incorporators and first board of directors of the company are: J. S. Butrum, of Decatur; Robert B. Hennigh, of Prairie Home; Robert H. Woodward, Harold R. Woodcock and John M. Turner, of Macon.

GALESBURG, ILL.—At the annual meeting of the stockholders of the Galesburg Electric Motor & Power Company, held July 9, the old board of directors was re-elected for another year, and John G. Vivion was chosen to succeed the late Wilkins Seacord. The other directors are: B. F. Arnold, Robert Chappell, W. W. Babcock, J. K. Mitchell, G. L. Price, Fred Seacord and Loren Stevens. The usual reports were received and submitted to committee for examination and the board of directors did not meet at the close of the session of stockholders. The present officers will hold over until the meeting of Aug. 7.

INDIANAPOLIS, IND.—The County Board of Review defends adverse criticism of its action in having reduced the assessment for taxation against the Indianapolis Street Railway Company $500,000, asserting that at the time the State Board raised the valuation to $3,000,000 last year, there was prejudice against the company. The Board says that it is certainly unfair to assess the regular dividend-paying companies like the Belt Railroad and Stock Yards companies and the gas companies at $2,500,000 and $1,000,000 respectively, and placed the Indianapolis Street Railway Company at $3,000,000, when no dividends were being paid and the stock selling for 22 cents. The company's revenues, it was said, were also reduced $30,000 a year by its bonus to the city, the people were getting a 4-cent fare and the system was being improved at large expense.

FT. WAYNE, IND.—The Knickerbocker Trust Company, of New York City, has entered suit in the United States District Court against the Lake Side Street Railway Company, asking that a receiver be appointed for the company and seeking to foreclose a mortgage on the property for $60,000, with accumulated interest. The suit is also against the Ft. Wayne Traction Company. The petition asks that the entire plant be sold to satisfy the claim, and that if the proceeds of the sale be not sufficient to satisfy the mortgage, the bondholders be made personally liable. It also asks for an injunction prohibiting the directors from transferring any of the property of the road without the consent of the court.

ROCKVILLE, MD.—At a special meeting of the Mayor and Council, held July 7, the ordinance granting the Washington & Rockville Electric Railway Company right of way along the main street of the town from the present terminus of the road at the fair grounds to the court house was rejected, and a committee, consisting of Mayor Spencer C. Jones and Councilman Hattersley W. Talbott, was appointed to prepare an ordinance which will meet with the approval of the Council, as well as the wishes of the people of the town. The law requires that the action of the Council shall be ratified by a majority vote.

BANGOR, MAINE.—The employees of the street railway companies operating in this city received the following notice from the Bangor Young Women's Christian Temperance Union July 3: To the conductors and motormen of the electric cars, the members of Elizabeth Yates, Y. W. C. T. U., wish to express their sympathy for the long and fatiguing labors of the men who run the cars; and as a token of respect felt for the constant care and kindness shown to those who ride, and for the fortitude which faces all the weather that comes seven days in the week; and as an invitation to the total abstinence principles which in railroad men are so important to the safety of the public, they hereby extend an invitation to each superintendent, conductor and motorman to call at the waiting room, 17 Main Street, on Wednesday, July 4, after 9 o'clock a. m., and receive a bouquet. The Ys.

MILFORD, MASS.—As the result of an agreement which was reached July 12, the Milford, Attleboro & Woonsocket, the Milford, Holliston & Framingham, the Marlboro, Westboro & Grafton street railway companies have virtually combined their interests. Directors I. A. Kensey, G. A. Butman, I. W. Downs and James Harwood, of the Milford, Holliston & Framingham Street Railway, have formally petitioned to the Selectmen of Milford for permission to extend their line to the Hopkinton town line.

WEBSTER, MASS.—Car No. 14 of the Worcester & Webster Street Railway Company collided with car No. 13, of the Webster & Dudley Street Railway Company shortly before 8 o'clock on July 4, killing two persons and injuring forty. The accident occurred at a point opposite the estate of the late W. S. Slater at East Webster.

WORCESTER, MASS.—A car of the Worcester Consolidated Street Railway Company jumped the track on July 9 and crashed into a farm wagon, spilling the market vegetables, which the latter contained, over the roadway. Three passengers were injured by the accident.

IONIA, MICH.—There are prospects of a bitter franchise fight here. Frank H. Talbot, of Detroit, has signified his intention to build an electric railway from Ionia to Saranac, Lowell, Ada and Grand Rapids, and now T. B. Preston, representing Ionia and Detroit capital, has announced that he will apply to the Council for a line to take in the Crystal Lake resort, with the probable extension later to Portland, Grand Ledge and Lansing. As the latter proposal is largely backed by local capitalists there are at this early date indications of partiality for the local enterprise.

DETROIT, MICH.—A car of the Sherman Street line here jumped the track July 4. Six persons were injured by the accident.

ST. LOUIS, MO.—The St. Louis County Court has passed an order granting the St. Louis & Fenton Railway Company an extension of time in which to begin work on its proposed electric line from the city limits at the Morris Road to Fenton.

NEVADA, Mo.—At a recent meeting of the Missouri Water, Light & Traction Company, Thomas Donahoe and Miss Ida Moran were elected directors to fill the vacancies caused by the resignation of S. A. Wight and C. M. Shartel. H. M. Duck resigned as treasurer of the company and was elected vice-president, and Miss Ida Moran was chosen treasurer of the company.

KANSAS CITY, MO.—Two persons were injured in a rear-end collision of electric cars here, at Independence Avenue and Campbell Street, on July 4.

ST. LOUIS, MO.—The St. Louis Transit Company has just put in operation two loop systems, which are intended to relieve the congestion on the Transit lines in the West End. The new loops will greatly facilitate the handling of heavy crowds which patronize the summer gardens and other resorts in this district.

CAMDEN, N. J.—The street committee of the Camden City Council has adopted the Bonham fender, with the Sterling wheel guard, for use on all trolley cars in Camden. This fender had been selected by the Camden & Suburban Railway Company.

WESTFIELD, N. J.—On July 11 the Westfield & Elizabeth Street Railway Company reduced the fare from this place to Rahway from 10 to 5 cents, and passengers are now being carried from the Westfield to the Rahway depots at that price. The company is now preparing a ticket which will be good for a continuous ride from Elizabeth to Boynton Beach for 20 cents, providing the passenger asks for the ticket when the fare is paid. The regular fare to Boynton Beach at the present time is 25 cents. This new ticket will be put in use at an early date.

BROOKLYN, N. Y.—The gripmen and conductors on the Brooklyn Bridge have been organized into an open union, under the auspices of the American Federation of Labor. A charter was received from the A. F. of L. a few days ago, and the organization will be known as the New York and Brooklyn Bridge Employees' Protective Association. The members deny that they have organized for the purpose of making new demands.

LIBERTY, N. Y.—The Liberty & Jeffersonville Electric Railroad Company has contracted with the Houk Falls Power Company, of Napanoch, to furnish power for operating its new road.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week in order to secure insertion in the current issue.

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Separate Car Acts in Montgomery and Columbus

The City Council of Montgomery, Ala., has passed an ordinance requiring the Montgomery Street Railway Company to provide separate cars for the transportation of whites and negroes. The company is given thirty days in which to comply with the conditions of the ordinance. The ordinance passed by the Council of Columbus, Ga., differs from that passed by the Montgomery Council in that it provides for the separation of the whites and blacks in the same car, and does not require the operation of special "black" cars. By the terms of the latter ordinance the motormen and conductors are compelled to assign seats to passengers, the front half of the car being reserved for the whites and the rear half for the negroes. If a passenger refuses to take a seat assigned him he is liable to a fine, or if the motorman or conductor fails to assign a seat he is liable to a fine.

Rapid Transit Commission for Cleveland

At a recent meeting of the City Council a resolution was introduced calling for the appointment of a rapid transit commission. The object of the commission, as explained in the resolution, is to arrange, if possible, private rights of way for the suburban electric lines from the city limits to the Public Square, in order to allow them to make the same time in the city as outside, bringing the suburbanites into the heart of the city at steam railway train speed. The resolution states that there are many streets in Cleveland traversed by suburban cars which travel at a rate of speed exceeding that fixed by the city ordinance covering this point. This, the resolution states, is a menace to the safety of the public and should not be allowed. It is conceded, on the other hand, that the suburbanites and also the citizens living in the outskirts of the city have the right to be brought down town and taken back to their homes with as much dispatch as possible. The resolution further states that the increased population in the outskirts demands speedier service. The commission, as set forth in the resolution, is to consist of five members, whose duty it shall be to arrange a special service, if possible, and one that will prevent accident.

Verdict in Favor of the Brooklyn Rapid Transit

The Appellate Division of the Supreme Court in Brooklyn has decided, in a test case submitted, that the Brooklyn Rapid Transit Company has a legal right to charge a 10-cent fare to Coney Island. The case was that of Arthur Barnett, who got a judgment for $65 against the company for being ejected from a car after refusing to pay an extra 5 cents. Justice Hirschberg writes the decision, and his associates concur except Presiding Justice Goodrich, who was absent. The decision, which is quite voluminous, sustains these points:

First—That the Brooklyn Heights Company legally leased the Sea Beach Railroad.

Second—That this lease carries with it the right to charge an extra 5-cent fare.

Third—That the Sea Beach road received its charter before the One-Fare law was passed.

Fourth—That the One-Fare law did not refer to roads with a steam railroad franchise.

In closing Justice Hirschberg says:

"From the statutes and decisions cited it would seem evident that the defendant is entitled to make the charge complained of unless prohibited by the fact that it operates a street railway in connection with the Sea Beach road. As Section 101 of the Railway law does not apply to the latter road the 5-cent fare provision can have no force in this connection. There is, consequently, no express legislative prohibition, and surely there is no occasion for a forced construction of the law for the sake of creating one. No reason can be suggested for such a construction of the Railway law as would permit the defendant to convey its passengers from the Brooklyn Bridge to Coney Island at a charge of two fares, provided the passengers were subjected to the annoyance and inconvenience of alighting at the junction of the two roads and there purchasing a ticket and boarding another car, but which would deprive it of the right to charge the second fare merely because it had voluntarily constructed a temporary union of the two roads at that point in order to promote the comfort of passengers by affording a continuous and uninterrupted transit."

The application of former Senator McNulty to annul the franchise of the company for charging the extra fare is still pending before the Attorney-General. He refused to become a party to the test case before the Appellate Division.

New York Railroad Commissioners Report on Brake Tests

On July 23 the State Board of Railroad Commissioners, of New York, issued a report on the official test which it made of automatic street-car brakes to supplant the hand brakes now in use. The tests were made nearly a year ago on Lenox Avenue, New York City, the Metropolitan Street Railway Company granting the Commission permission to make the test on its lines and with its cars. In its report the Board says:

"The Board has devoted much time to this test, and while nothing has been brought forth that will revolutionize the manner of stopping a car, the opportunity is afforded to present to the railway officers and to the public facts and figures showing what the best appliances known to-day can do in the matter of stopping a car quickly. While these results are very satisfactory, there is still room for much improvement, and the Board feels that its action in holding a public test will result in still further improvements in brakes or in new inventions which will reduce the distance within which a car can now be stopped, and it has the satisfaction of knowing that it has done all in its power to bring about the adoption of better brakes than those now used by the majority of roads in this State, and thus reduce the number of accidents.

"It is not the intention of the Board to recommend any particular brake for any class of service, leaving the selection to the judgment of the railway officers themselves. The Board will, of course, exercise fully its powers under the law to require of the companies the use of sufficient and safe equipment for the public service. After a careful consideration of the whole subject of brakes for electric cars, the Board has determined that, except in special cases where the liability of accident is very remote, the ordinary single chain and spindle hand brakes, now generally used, should be replaced by brakes made by one of the following manufacturers, or any other which, in the judgment of the Board, is hereafter shown to be equally efficient:

"Air brakes: The G. P. Magann Air Brake Company, the Standard Air Brake Company, the Christensen Engineering Company, J. E. Reyburn. Electric brakes: The Electric Selector & Signal Company, the General Electric Company. Friction brakes: The Peckham Motor Truck & Wheel Company, the J. G. Brill Company. Hand-power brakes: The Sterling Supply & Manufacturing Company, M. H. Vogel, the Sauvage Street Car Brake Company."

Department of Blanks and Forms

The secretary of the Street Railway Accountants' Association of America has issued the following circular:

(CIRCULAR NO. 14.)

New Orleans, La., July 16, 1900.

To the Members:

The value of the Department of Blanks and Forms can be greatly enhanced, from year to year, by the addition of the new forms issued by your company, and the refiling of those blanks reissued. Therefore, it is hoped and anticipated that you will cooperate with the secretary in the effort to make the department a continual advantage of membership in the association, and keep it sensitive to the changes of your blanks and forms.

As the rubber stamp comes naturally within the meaning and intention of this collection of forms, a separate book is to be devoted to rubber-stamp impressions, and there is no doubt that it will not be the least interesting of the whole. It is preferred that the impression be made upon white paper 4 ins. wide by 6 ins. long; each impression on a separate slip of paper. Print on one side only.

Electric lighting in many instances is managed in the offices of street railway companies. Electric lighting blanks are, therefore, of interest to those companies, and if your company has this adjunct, please include the blanks in your package.

Experience has shown the need of the following suggestions, and they are given with the hope that they will be heeded in forwarding your package:

1. Do not fold the blanks; rolling is preferred.

2. Write in ink the name of your company upon all blanks where same does not appear.

3. The term "blanks and forms" covers everything printed in use by your company, books, circulars, rubber stamps, tickets, transfers, statements and reports.

4. Please send at least two copies of all forms, except of rubber stamp impressions.

5. Address your package to W. B. Brockway, Secretary, Post-office Box 630, New Orleans, La., and advise by letter of its forwarding.

It is appreciated that you will be put to some trouble to comply with this request, but it is believed that you will do it willingly, for you understand the importance of the collection.

The companies that complied with the request made Circular No. 6, Nov. 15, 1898, will consider this request to apply to their issue and reissue since that date. But the companies which have joined since then will please include their entire issue at the present time. Yours truly W. B. Brockway, Secretary.

C. N. Duffy, President.

Some General Conditions Governing Power Station Design *

BY PHILIP DAWSON

At the present moment when electric traction is making such rapid strides, the question of the source of supply of power is a very important one. In this paper it is proposed briefly to consider this question from the economical point of view. This is the most important one, and the engineer's knowledge and experience should be used to design and construct the source of supply of electrical energy in such a manner as to furnish the board of trade unit at the switchboard at the lowest possible cost, interest on capital, depreciation and sinking fund included. It may be argued that the cost of the unit at the switchboard being low, it does not necessarily follow that the cost of the power, say, per car or per train mile will also be low, as it is possible that in order to secure cheap current the power station may be so located as to cause great expense in feeders, sub-stations and loss in the transmission. In the numerous cases, both in Great Britain, on the Continent and in America, which have come under my notice, I have never found this to be the case. This applies to power supply stations intended for traction and power primarily and lighting secondarily. It may be mentioned at once that the demand for current for both traction and power transmission purposes is increasing so rapidly that lighting will shortly in any case be only a secondary consideration.

The combination of a lighting and traction station is, therefore, not to be recommended, and good results cannot be expected. The case is, however, entirely different where traction and lighting are combined, and the best results are then obtainable; that is to say, where the station has been designed by experienced traction engineers for traction and lighting.

It may be of interest to consider what are the differences between a station designed for lighting and one designed for traction and power transmission.

The average number of hours per annum during which a lighting station will be running full load, will probably never be equivalent to more than three months' continuous running per annum; that is to say, taking the total kilowatt-hours generated in one year, and seeing how long the plant under consideration would have to run its full capacity continuously to generate this amount, this time would probably never exceed three months. Taking a representative traction station, the time of continuous running would probably be at least nine and in some cases ten and even eleven months.

A lighting plant must in three months earn enough money to pay working expenses and to pay interest and allow for depreciation and sinking fund for a whole year, whereas a traction plant has from nine to eleven months to do the same thing.

A lighting plant is, on an average, practically at a standstill eighteen hours a day, while a traction plant is running eighteen to twenty hours a day. Economical boilers, engines and electrical generating and transmission devices are, therefore, far more important in a traction than a lighting plant, because it is well known that running at very light loads and keeping the fires banked and the boilers, steam pipes, engines, etc., hot, uses very nearly as much fuel as running them at full load.

Furthermore, whereas in a lighting plant there is ample time to overhaul the plant and execute necessary repairs, the men during the day have little or nothing to do and can well do this work. In a traction plant there is little or no time to do this. The conditions are quite, if not more, arduous than on a ship.

* Paper read at the meeting of the Tramways and Light Railways Association, London, June 27, 1900.

There at least every few days or few weeks the whole plant is entirely shut down for several days and can be taken to pieces and overhauled.

Unexpected and rapid overloads must be able to be supported by the traction plant, which is not generally the case in lighting.

In a traction station it will be seen that a far greater figure is cut by the cost of generation pure and simple than in a lighting station, and that the question of interest on capital expenditure and sinking fund is relatively smaller in the former than in the latter.

The following figures, which are the result of actual experience, may be of interest, and show the influence of continuous running on the cost of production:

COST IN PENCE PER BOARD OF TRADE UNIT (KW-HOUR)

	Lighting. Pence.	Traction. Pence.
Fuel	0.3 to 2.2	0.09 to 0.5
Oil waste and stores	0.05 to 0.38	0.005 to 0.2
Wages and salaries	0.28 to 1.60	0.03 to 0.4
Maintenance	0.054 to 0.6	0.0025 to 0.06
Total	0.684 to 4.78	0.1275 to 1.16

The difference which exists between a plant working practically continuously and only intermittently is at once seen in the average amount of coal consumed per unit generated. The type of engine used must, however, also be taken into consideration.

Thus, taking the published results of British electric-light plants, we find that the cost of coal per unit generated varies approximately between 0.3d. and 2.2d. Comparing this to traction plants, we find the cost of coal varying between 0.09d. and 0.50d. per unit generated. Again, considering the item of wages and salaries in a lighting station, we have 0.3d. to 1.6d.; in the case of traction, this is 0.03d. to 0.40d. per unit. Comparing the total cost of production of one Board of Trade unit generated in a lighting station and in a traction station, interest and sinking fund excluded, in the former the unit varies from 1.00d. to 4.00d, as compared to 0.25d. to 1.00d. for traction purposes. The cost of power when generated for traction and power purposes is one-quarter of that when generated for lighting only.

The amount to be added for interest and sinking fund, of course, depends on the length of the concession, on the terms of final purchase and on the life of the machinery employed. The cost of producing power varies with the amount to be produced, decreasing as the amount increases. This shows the advisability of concentrating as much power as possible in one station, and reducing the number of units.

In considering the various items which go to make a complete power or traction installation, including the system of feeders, distributors, track and overhead line, the cost of the power station is but a comparatively small item. The saving which can be effected by a properly designed station is very great, and a little extra capital expenditure is in many cases well justified.

The total cost of running an electric tramway or railway varies between 2.50d. and 8.00d. per car mile, according to circumstances; the electrical energy at the power station required varying from 0.49 units to 1.4 units per car mile, according to the profile of the line and the weight and speed of the cars.

The cost of power varies between 10 and 30 per cent. of the total working expenses, all charges included, and if it can be reduced by ¾d. to 1d. per unit or we may say per car mile, as one unit at the switchboard is a fair estimate of the average power requisite at the switchboard per car-mile run, it is well worth doing.

In the early days, before polyphase high-tension currents were known, the situation of the central station was practically imposed, very little latitude being possible, owing to the maximum distance of economical transmission being limited. Electricity works being most required in crowded centers, it was not only difficult to obtain a site at all, but the cost of the ground was very great. Hence the necessity of crowding the greatest amount of power into the smallest possible space. The plants being mostly used for lighting, and only running a few hours each day, highly economical engines and boilers and labor-saving appliances were of but little advantage. At present, circumstances have altered; electricity can economically be transmitted to any distance, and is utilized—and will be more and more so every day—firstly for power purposes, and secondly for lighting purposes.

The initial cost of a plant may be roughly divided into four parts: Land and buildings; plant, including all machinery in station; mains, feeders and distributors; miscellaneous, which includes such things as meters, instruments, cost of provisional order, and such like.

According to Emile Garcke's figures in the Manual of Electrical Undertakings, the average cost of existing British plants expressed in percentage of total capital expenditure is approximately as follows:

Land and buildings	19 to 23 per cent
Machinery and plant	35 to 37 per cent
Various remaining items	4 to 14 per cent

As regards the first item the above average includes several old lighting stations, and there is little doubt that if a new plant was installed the cost of land could be materially reduced.

The question of system of generation, whether in several large stations generating continuous current or in one large station generating either continuous or polyphase currents, is of great moment.

As already stated, in a traction station much greater capital expenditure is justified, and coal-handling appliances can be installed which enable one or two men to look after the largest boiler-room. Automatic lubricating system and ash conveyors, etc., enable one or two men to be sufficient in the largest engine-room. It will be evident that the item wages and salaries will be far greater in several than in one station. Also, the waste of coal, etc., will be far greater. From a careful study it is nearly certain that for anything above 5000-kw capacity, one polyphase station operating rotary converter sub-stations is the best. Large units are also always advisable. It interests me to see that the sizes I recommended several years ago are generally being adopted. For reference, it may, perhaps, be advisable to append this table:

SIZES OF ENGINES RECOMMENDED FOR USE IN POWER STATIONS

Maximum Power Required. ihp.	Number of Egines.	Power of each Engine. ihp.
200	2	200
400	3	200
600	3	300
1,000	3	500
1,500	4	500
2,000	4	750
5,000	6	1,000
10,000	6	2,000
20,000	6	4,000
40,000	9	5,000
60,000	11	6,000
90,000	10	10,000

All engine builders who have had experience in tramway work now make an entirely different kind of engine for traction from that which they supply for lighting stations. The conditions under which a tramway engine works are, if anything, more onerous than those of a rolling-mill engine. A slight variation, either in number of revolutions per minute, or in angular velocity per revolution, is of the greatest importance in a traction station, whereas it is of small importance in a rolling-mill.

A uniform speed is especially important where compound-wound dynamos are run in parallel direct on to the line. If the momentary difference in speed between two engines exceeds very narrow limits, the voltages of the machines differ, and cause very heavy currents in the equalizing bars and largely increased core losses, hence great waste. If the difference becomes too great, one of the generators may even be reversed. Where polyphase machines run in parallel, constant speed is of even greater importance to keep the machine in step. In cases where shunt-wound generators with heavy batteries of accumulators run in parallel on the line, the question of engine regulation is not so important.

A traction station where compound-wound dynamos are used should be so arranged that, if the normal load be suddenly thrown on or off an engine, the speed shall not vary more than 2 per cent either way. In some cases a maximum variation of 1½ and 1¼ per cent is all that is allowed. Where polyphase currents are used, constant speed is of even greater importance; and a guarantee should be required that under no circumstances shall the angular velocity during one revolution vary more than ½ per cent, and in some cases not more than half of 1 per cent. With heavy fly-wheels and governors properly designed for tramway work, it is quite practicable to fulfil the above conditions, or, expressed in a different way, in polyphase work the engine should not produce by variation of angular velocity a phase displacement of more than 5 degs. per half cycle.

From careful comparison of many existing systems it may be taken that the total cost of power, all fixed charges included, for one large station, as compared to that for two or more smaller stations, together equal in power to the larger one, is from 30 to 75 per cent lower.

Profits on Tramway Undertakings*

BY C. H. GADSBY, Wh. Sc., M.I.E.E.

All tramway directors and managers and the members of municipal tramways committees are alike interested in the great question of establishing in the working of their undertakings as great a difference between gross receipts and working expenses as it is possible to obtain, and I think, therefore, I need offer no apology for bringing this subject before those of you who have done me the honor of coming to hear this paper. My only regret is that in the short time at my disposal it is impossible to go more fully into a subject so worthy of investigation and requiring so close a study of detail.

It is an easy matter to increase the gross receipts upon almost any tramway by increasing the services or by affording additional inducements to the traveling public. It is also an easy matter to reduce the working expenses by curtailing the services, employing cheaper labor, and by many other means, some only temporary, others permanent. The problem is—how to increase the gross receipts without at the same time unduly increasing the working expenses. It is not sufficient merely to establish a low *ratio* between working expenses and gross receipts unless at the same time the actual *difference* between them is great.

Naturally the first direction in which one turns for improvement is toward increased gross receipts. Such an increase may be effected by raising or reducing the fares according to circumstances, by increasing the services, by putting on better cars, by better heating and lighting, by better attention, and by numerous other means, but of course the increase of service is the one to which receipts respond most readily.

The table A shows the increments in receipts upon a certain English steam tramway resulting almost entirely from the gradual and judicious adoption of more frequent service. In this instance it will be seen that the mileage has been doubled in seven years; the number of passengers has been more than doubled, as have also the gross receipts, while the working expenses have been increased only about 70 per cent, and the resulting net receipts have been multiplied by 3½. This has been effected without any change of system, without any unusual development in the district or any extension of the line. There has been a substitution of a portion of double line for single, to permit of the more frequent service, but the improvement may be justly attributed simply to the increased service.

TABLE A

Year	Mileage	Passengers	Gross Receipts	Receipts per Car Mile	Working Expenses	Expenses per Car Mile	Ratio Receipts to Expenses	Net Receipts
			£	Pence	£	Pence	Per Cent	£
1893	260,153	4,079,993	17,939	16.5	12,327	11.3	68	5,612
1894	267,150	4,250,343	19,187	17.2	12,793	13.7	62	6,394
1895	370,373	5,286,608	23,271	15.07	14,022	9.08	60	9,249
1896	418,840	6,425,348	28,033	13.6	14,984	8.5	53	13,049
1897	470,612	7,450,492	32,316	11.5	16,908	8.6	52	15,408
1898	497,813	8,144,917	35,393	17.06	19,861	9.5	56	15,532
1899	523,073	8,818,047	38,453	17.6	20,438	9.3	53	18,015

It is interesting to note that in this case the receipts per car mile have increased from 16.5d. to 17.6d., while working expenses have fallen from 11.3d. to 9.3d., and the ratio of working expenses from 68 per cent to 53 per cent.

It is not to be expected that the gross receipts can be increased in the same proportion as the mileage, and consequently, as a general rule, the receipts per car mile are reduced. It is a knowledge of this fact that has in many instances led tramway managers to adopt the policy of restricting the mileages in an endeavor to secure high receipts per car mile.

Receipts per car mile on British tramways vary from a lower limit in the region of 7d. to a higher one approximating to 2s. per car mile. Except under very exceptional circumstances any manager working a line so as to obtain gross receipts anywhere in the neighborhood of this higher limit does not fully appreciate the necessities of his district or of the earning capacity of his system.

I consider that for electric and cable lines any rise in receipts per car mile above 9d. should be at once checked by an increased mileage.

In the case of horse tramways, a similar process should be applied whenever the receipts rise above 12d., and in steam lines when above 14d. or 15d. Take an example: Suppose we have a system running 1,000,000 car miles per annum, with gross receipts at 12d. per car mile:

	Per Annum
Total gross receipts will then be	£50,000
Suppose working expenses are at 60 per cent, and therefore amount to	30,000
Net receipts will be	£20,000

Let now the mileage be increased 20 per cent, that is to 1,200,000 car miles per annum, and suppose the total gross receipts increase only at the less ratio of 15 per cent, and that in consequence of standing and managerial charges being spread over a greater mileage, the working expenses increase only 15 per cent also. We shall then have

	Per Annum
Total gross receipts	£57,500
Total working expenses	34,500
Net receipts	£23,000

In this case the gross receipts per car mile work out at 11½d., that is by increasing the mileage 20 per cent we have reduced the receipts per car mile from 12d. to 11½d., but have at the same time made an extra £3000 per annum clear profit.

It may be of interest to compare the working expenses of tramways with different motive powers.

Table B may be taken as a fair average of the working expenses of a horse tramway. It is derived by taking the average of the actual figures on five representative town tramways in this country for the year ending June 30, 1899. From this it will be observed that the average total working expenses amount to 9½d. per car mile, whilst horse power with renewals amounts to 4.19d. per car mile, and traffic expenses to 3.05d.

TABLE B

OPERATING EXPENSES ON ENGLISH HORSE TRAMWAYS

Line	Maintenance of Permanent Way	Horse Power	Renewals of Horses	Repairs of Cars	Traffic Expenses	All Other Expenses	Totals	Mileages
	£	£	£	£	£	£	£	
A	2,223	21,418	1,797	3,430	18,824	4,676	52,368	1,502,448
B	113	4,614	315	412	3,884	2,356	11,694	293,343
C	1,656	15,491	2,000	2,164	12,178	2,496	35,985	870,286
D	1,504	9,467	1,224	1,148	8,108	1,671	23,122	646,150
E	2,010	11,938	2,711	3,445	8,495	8,335	36,934	749,461
Totals	7,506	62,928	8,047	10,599	51,489	19,534	160,103	4,061,688
Average pence per car-mile	Pence 0.44	Pence 3.72	Pence 0.47	Pence 0.63	Pence 3.05	Pence 1.15	Pence 9.5	

Table C shows a similar statement of working expenses for steam tramways derived from the actual figures for representative tramways in this country. The striking figure in this table is that engine power costs 3½d. per car mile while repairs cost 1¾d. per car mile, together making 5¼d. The permanent way repairs are naturally heavier than for horse traction, the traffic expenses are lower, chiefly on account of the drivers' and conductors' wages being spread over a greater mileage in consequence of the higher speeds than with horse traction. The total costs amount 10¾d. per car mile, or 1d. per car mile higher than for horses, so that the advantage of steam over horse working is due to the higher receipts per car mile consequent upon the use of larger cars.

TABLE C

OPERATING EXPENSES ON ENGLISH STEAM TRAMWAYS

Line	Maintenance of Permanent Way	Locomotive Power	Repairs of Engines	Repairs of Cars	Traffic Expenses	All Other Expenses	Totals	Mileages
	£	£	£	£	£	£	£	
A	3,291	1,586	1,486	581	4,474	1,610	13,128	248,735
B	3,627	16,335	7,990	1,739	6,051	2,879	38,621	883,991
C	625	1,048	282	...	3,948	2,568	8,471	188,348
D	2,139	8,223	4,030	1,130	3,178	3,058	21,798	472,652
E	984	1,748	889	388	1,446	736	6,191	181,739
Totals	10,666	28,940	14,677	3,838	19,097	10,851	88,209	1,975,465
Average pence per car-mile	Pence 1.30	Pence 3.51	Pence 1.78	Pence 0.46	Pence 2 32	Pence 1.31	Pence 10.7	

Table D gives the working expenses for eight electric lines in this country. All of the lines are operated on the overhead system, some by their municipal owners, and others by companies. It is in this case somewhat difficult to apportion the costs on account of the lack of uniformity in the allocation of charges.

*Paper read at the meeting of the Tramways and Light Railways Association, on June 29, 1900.

It will be noticed that the cost of motive power is much lower than with horses or steam, being only 1.36d. per car mile, or with engine and dynamo repairs 1.685d.

TABLE D

OPERATING EXPENSES OF ELECTRIC TRAMWAYS IN GREAT BRITAIN

LINE	Maintenance of Permanent Way	Motive Power	Repairs of General Plant	Repairs of Cars	Traffic Expenses	All Other Expenses	Totals	Mileages
	£	£	£	£	£	£	£	
A	1,277	1,722	954	1,401	3,837	1,855	11,046	283,718
B	811	939	159	427	3,703	927	7,676	239,472
C	350	1,545	565	700	2,206	924	5,725	204,257
D	557	3,404	330	1,307	3,349	2,792	11,739	267,750
E	172	956	709	201	1,413	1,231	4,582	135,740
F	12	1,104	250	336	1,535	454	3,691	161,156
G	2,121	1,700	394	460	7,784	1,398	13,857	564,389
H	4,362	6,191	535	2,430	9,768	4,971	28,257	1,160,279
Totals	9,662	17,465	3,836	7,262	33,595	14,552	86,573	3,016,761
Average pence per car-mile	.765	1.38	.305	.576	2.67	1.15	6.896	

It might be expected that the items for car repairs would be higher than with horse or steam traction on account of the repairs of motors and electrical equipments being now included, but as a fact the figure per car mile is about the same. I think this is accounted for by the fact that although the expenditure on each electric car is greater than on each steam or horse car, the charge per car mile is not greater on account of the greater daily mileage run by an electric car.

The item for traffic, which, of course, consists chiefly of drivers' and conductors' wages, is much the same for all three systems.

The total expenses of 6.8d. per car mile is somewhat higher than is generally expected with electric traction, this being due to the inclusion in the list of a number of small undertakings recently started, upon which it is reasonable to suppose improvement will be effected. When data are available from the many larger municipal undertakings just open or undergoing conversion, it is evident that an average total expense between 5d. and 6d. per car mile will be easily attained. In some cases in the table this has already been done, in the instance of line H the figures work out at 5.8d. per car mile, and on line G at 5.75d., while at Leeds, which is not included in the list, total working expenses are reported well under 5d. per car mile.

Table E gives the operating expenses per car mile well in detail for twenty-three American electric roads, and it is interesting to observe how closely this agrees with English working, notwithstanding the very different conditions.

Four years ago I had some difficulty in persuading a director of a certain large tramway undertaking in this country that there would be any reduction of working expenses by the adoption of electric traction, and at that time the figures I have given were not available. It is now scarcely necessary to point out that these figures show beyond doubt the great saving to be effected by the adoption of electric traction. This is the means that will be taken to reduce working expenses on every horse and steam tramway throughout the country during the next five or six years.

Having adopted electric traction there is still necessity for carefully watching operating expenses. In the first place the expenditure on track repairs may be anything from .05d. per car mile to 1.5d. It is necessary to keep sufficient men on the track to

TABLE E

OPERATING EXPENSES ON AMERICAN ROADS

DISTINGUISHING NO. OF ROAD	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11
Miles of track (as single)	48.6	13.65	11.15	6.29	20.56	64.71	12.93	10.5	17.0	4.75	11.25
Number of cars. Open	71	20	2	15	46	39	15	13	25	9	10
" " " Closed	45	12	11	10	53	78	12	8	21	4	10
" " " Plows	7	3	2	+3 freight 1	2	18	2	2	4	1	1
" " " Sweepers	2	----	----	----	1		----	----	----	----	----
" " " Sprinklers	1	----	1	1	----		----	----	----	----	----
Car-miles per annum	1,721,147	401,284	350,635	267,229	1,308,660	2,814,072	254,835	337,260	583,951	117,598	300,408
Passengers per annum	6,383,503	2,600,458	1,661,703	1,049,044	5,538,585	10,854,971	631,836	629,655	2,061,094	487,954	1,181,558
Average number of employees	200	65	45	30	186	470	60	24	75	15	33
DETAILS OF OPERATING EXPENSES—	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence
Road-bed and track	.025	.405	.175	.085	1.290	.475	.555	.340	.395	.185	.005
Building repairs and fixtures	.020	.020	--	.125	.055	.025	.180	.020	.010	----	.005
Electric line construction repairs	.010	.175	.045	.080	.165	.075	.245	.020	.130	.065	.235
Car repairs	.315	.455	.250	.640	.450	.420	.655	.045	.185	.365	.075
Repairs to electric gear on cars	----	.160	.185	.325	.205	.340	.550	.175	.430	.120	.065
Electric motive power	.555	1.500	1.485	.610	.630	.955	1.680	1.210	1.195	2.045	1.680
Wages	2.675	2.875	2.395	2.845	2.935	3.155	2.980	1.855	2.660	2.660	2.975
Removal of snow and ice	.030	.050	.020	.010	.045	.100	.025	----	----	.035	.015
Damages, gratuities, etc	.095	.035	----	.140	.045	.185	.150	----	.145	.005	.015
Insurances	.565	.495	.330	.055	.045	.045	.195	.105	.475	.055	.085
Salaries	.245	.365	.540	1.005	.785	.260	1.240	.135	----	.635	.665
Horsing expenses	.050	----	----	----	.015	.075	----	----	----	.045	----
Legal expenses	----	.315	.270	----	----	.020	----	----	----	----	----
General expenses	.345	----	----	----	----	----	1.000	.485	----	----	----
Miscellaneous other expenses	----	.635	.240	2.045	1.175	.440	.140	1.725	.930	.590	.050
Total operating expenses per car-mile	4.930	7.515	5.935	8.015	7.840	6.520	9.595	6.065	6.460	6.755	5.870
Gross receipts	9.330	10.650	9.300	10.455	10.740	9.440	10.640	7.725	8.960	9.920	9.580

DISTINGUISHING NO. OF ROAD	No. 12	No. 13	No. 14	No. 15	No. 16	No. 17	No. 18	No. 19	No. 20	No. 21	No. 22
Miles of track (as single)	25.5	7.2	7.25	16.85	12.46	1.5	10.24	11.46	5.25	4.11	16.77
Number of cars. Open	39	16	9	16	14	----	7	26	2	2	52
" " " Closed	34	6	9	8	13	3	6	20	3	3	39
" " " Plows	4	1	1	1	1	----	----	2	----	----	4
" " " Sweepers	----	----	----	----	----	----	----	1	----	----	----
" " " Sprinklers	----	----	1	----	----	----	----	----	----	----	----
Car-miles per annum	1,181,206	212,323	241,532	289,290	297,265	49,385	183,060	490,656	61,320	3,916	921,468
Passengers per annum	4,466,080	1,136,548	1,099,843	1,126,875	1,987,519	101,958	629,082	2,823,684	157,555	6,669	5,345,848
Average number of employees	165	23	27	30	45	7	27	75	8	5	150
DETAILS OF OPERATING EXPENSES—	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence
Road-bed and track	.260	.370	.040	295	.815	.305	.205	.385	.775	----	.190
Building repairs and fixtures	----	.050	.015	.010	.020	.125	.020	----	.005	----	.020
Electric line construction repairs	.045	.040	.045	.185	.095	.105	.060	.105	.095	.405	.145
Car repairs	.325	.320	.355	.170	.245	.245	.095	.435	----	----	.340
Repairs to electric gear on cars	.240	.200	----	.160	.505	.120	.135	.130	----	----	.295
Electric motive power	1.100	1.830	1.450	1 235	1 890	1.125	2.190	1.490	1.050	1.785	1.025
Wages	2.610	2.470	3.110	2.290	3.100	1.465	2.215	3.565	2.580	3.160	3.640
Removal of snow and ice	.030	----	.010	.025	.030	----	.035	.035	.050	----	.010
Damages, gratuities, etc	.025	----	.565	.045	----	----	.015	.020	----	----	.035
Insurances	.080	.400	.055	.290	.415	.050	.210	.140	.025	.920	.265
Salaries	.225	.890	1.060	.300	1.130	1.625	.360	.360	----	----	.615
Horsing expenses	----	----	----	----	----	----	.190	.055	.495	----	.070
Legal expenses	----	----	----	.020	----	----	----	.190	----	----	----
General expenses	----	----	----	.230	----	----	----	.050	----	8.685	.545
Miscellaneous other expenses	.340	.465	1.405	.440	1.020	.275	.995	.400	----	----	1.120
Total operating expenses per car-mile	5.280	7.035	8.125	5.695	9.310	5.455	6.725	7 360	5.075	14.955	8.315
Gross receipts	9.300	12.40	11.08	8.670	14.260	5.240	8.305	14.005	5.340	16.545	13.695

keep pace with the wear, and the old proverb, "a stitch in time saves nine," is eminently applicable to track repairs, but it is at the same time an easy matter to waste money by having too many men on the work, who will always find or make something to do.

Then, again, the item for motive power may be anything from .5d. to 2.0d. per car mile. The first care in this respect should be as to the consumption of current upon the cars, which may on level roads with small cars and careful manipulation of the controller work out as low as .6 B. of T. units per car mile, or may, on heavy roads, with careless driving, amount to 1.3 or 1.4 B. of T. units per car mile.

Having reduced the consumption of current upon the cars, the next point is to secure its economical production. To effect this it is necessary to see that the fuel is of the most suitable character, having due regard to cost, and remembering that the lowest priced fuel is not always the cheapest, and that the furnaces are of the best type for dealing with it. It is also of the utmost importance for economical production that the engines and dynamos are of the proper power, so as to be fairly fully loaded without risk of injurious overloading in the heavy fluctuation of traffic.

In table F I give the sizes of a generating plant I have found suitable for operating lines with various numbers of cars under ordinary conditions.

TABLE F

Generating Plant for Various Numbers of Cars in Service on Electric Lines Under English Conditions

No. of cars	5	10	15	20	25	30	35	40	45	50
No. of sets of generating plant, including reserve	2	2	2	2	2	2	3	3	3	3
Power of each set in kilowatts	60	125	175	225	275	300	175	200	200	225

No. of cars	55	60	65	70	75	80	85	90	95	100
No. of sets of generat ng plant, including reserve	3	3	3	3	3	3	3	3	3	3
Power of each set in kilowatts	250	250	275	275	300	300	325	325	350	350

It is, of course, important that the plant shall be of the most economical description, but judgment must be used in selecting the plant, as to whether it shall have simple, compound or triple expansion engines, and as to whether it should be even condensing or non-condensing, as particularly in small plants in districts where fuel is cheap it may be found that where repairs, attendance, water, etc., are taken into account, it may be cheaper to adopt a non-condensing engine using 25 lbs. of steam per ihp per hour than a condensing engine using, say, 18 lbs. of steam per ihp per hour.

Then, again, there is the all-important matter of traffic expenses, which generally amount to about half the total cost of operating electric cars. Wages and hours for drivers and conductors are now fairly uniform throughout the Kingdom, and there is not much scope for cutting in this direction, and it is in the careful arrangement of shifts, and in the reduction of lost time at end of stops that reductions may be made. On many lines with short branches a very large proportion of the men's time is wasted while the cars are standing at termini. Cars should, as far as possible, be kept moving all the time, only sufficient time being allowed at the ends of the journeys to allow for turning the trolley pole and loading. In this way a good deal more mileage will be got out of both men and cars.

With the higher speeds in America it is common practice to get 100 to 120 miles per day out of a car, while in this country there are plenty of instances where electric cars are only doing 35 to 40 miles per day. Even with the limitations of speed to which we are here subjected, much better than this should be done.

These remarks have been based upon the operation of overhead trolley lines, but apply generally to electric conduit lines upon which, if substantially built, the working expenses will be much the same, the only difference being a small increase for repairs and maintenance of the conduit, conductors and collectors.

I have not included any statement as to the operation of cable lines, although these are worked at remarkably low rates, as low, in fact, as many electric lines, chiefly because there are only three systems of any magnitude in operation in this country, and there has been very little recent development in them.

I think we are justified in drawing from this small investigation the following conclusions:

1. That it is generally possible by increased services to increase the gross receipts.

2. That the operating expenses do not increase at the same rate as the mileage, and generally at a less rate than the receipts.

3. That services judiciously increased generally result in larger net profits.

4. That electric traction constitutes the readiest means of increasing the receipts, and at the same time of reducing working expenses.

5. That on tramways already equipped in this country there is scope for reduction of operating expenses and increase of profits.

I have to acknowledge my indebtedness to the Street Railway Journal, New York, to the compiler of "American Street Railway Investments," and to the officials of the various undertakings, whose figures have been cited, for their kind assistance in the preparation of this paper.

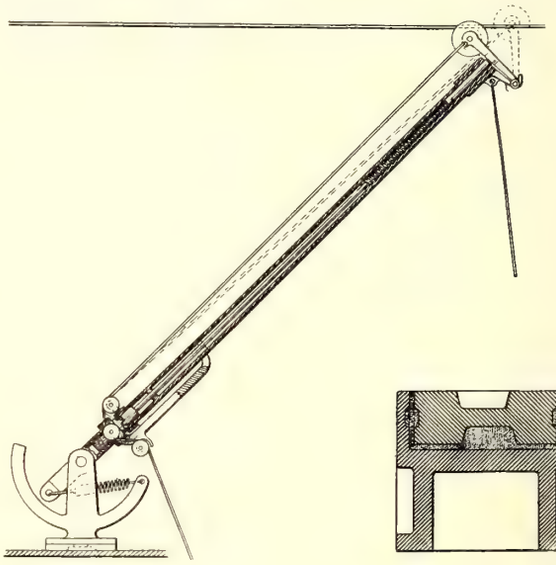
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

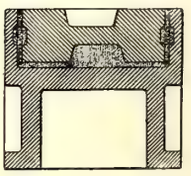
UNITED STATES PATENTS ISSUED JULY 17, 1900.

11,842. Reissue Fare Register; J. F. Ohmer and H. Tyler, Dayton, Ohio. App. filed May 11, 1897. The most important feature of this invention consists in actuating the total or trip registering device by means of mechanism arranged to be engaged or operated in common by each one of the individual fare indicator and register operating devices. The invention is an improvement upon the register described in patent No. 560,529.

653,649. Underground System of Electric Railway; C. A. Balph, Pittsburgh, Pa. App. filed Sept. 14, 1897. The main conductor is carried in a rubber or leather tube and connects with the sectional conductor by means of plugs carried by the latter and passing through the wall of the tube.



PATENT NO. 654,050



PATENT NO. 653,845

653,694. Car Fender; G. B. Quarrier, Los Angeles, Cal. App. filed April 5, 1900. Details of that type of fender in which the obstruction releases a latch to throw the fender into operative position.

653,769. Car Step; S. B. Fuller, Pawtucket, R. I. App. filed Sept. 13, 1897. Auxiliary steps are fitted with gearing so that the motorman or conductor can fold them up or open them at will from the platform, such steps being adapted for the higher cars.

653,780. Emergency Brake Setting Mechanism; W. H. Sauvage, Denver, Col. App. filed Sept. 12, 1899. By the movement of one lever the motorman can throw down the fender, apply the brakes and open the sand-box.

653,845. Railway Track Structure; H. O'Shea, Johnstown, Pa. App. filed Nov. 7, 1899. The plate which carries the track grooves at crossings, frogs, etc., are made double, i. e., with the grooves on both sides, so that the plate can be reversed when one side is worn out.

653,879. Motor Vehicles; L. J. Phelps, Melrose, Mass. App. filed May 19, 1900. The weight of the operator is utilized to keep a constant friction on the controller shaft and thereby hold it at any point to which it may be moved.

653,930. Fender for Tramway of Like Vehicles; J. Vonholt, Hamburg, Germany. App. filed Oct. 30, 1899. This fender is an elastic frame arranged at an angle and fitted with a number of vertical rollers so that the obstruction will be pushed to one side.

653,958. Convertible Open and Closed Car; F. Hoffer, Cohoes, N. Y. App. filed April 10, 1900. The side panels are made in sections hinged together so that they may be folded to occupy a small space beneath the roof of the car, when the car is operated as an open one.

653,975. Guard-Rail Fastener; D. F. Vaughan, Haddonfield, N. J. App. filed March 3, 1900. Details.

654,039. Spring Box for Frogs, Switches, Etc.; W. Wharton, Jr., Philadelphia, Pa. App. filed May 31, 1900. A special method of forming the box, for economy of manufacture.

654,050. Trolley Pole; C. A. Brown, Lorain, Ohio. App. filed Aug. 22, 1899. When the wheel leaves the wire it releases a catch which allows a spring to lower the pole.

654,105. Electric Railway Appliance; D. E. Shoop, Turtle Creek, Pa. App. filed Dec. 9, 1899. This trolley runs on top of the wire, and in order to pass crossing wires there are two trolley wheels on the same axis, which shift from one wire to another at the crossing.

PERSONAL MENTION

MRS. J. C. HUTCHINS, wife of Vice-President Hutchins, of the Detroit, Mich., Citizens' Street Railway Company, is dead.

MR. CHARLES L. HENRY, general manager of the Union Traction Company, of Anderson, Ind., had his leg broken below the knee a few days ago by a kick from a horse.

MR. A. A. McLEOD has resigned as president of the American Railways Company, of Philadelphia. William F. Harrity, vice-president and general manager of the company, has been tendered the place, and it is believed that he will accept it.

MR. HENRY C. PAGE has been appointed superintendent of the entire Lynn & Boston Railroad system. Mr. Page was formerly superintendent of the Salem division of the system, which position he has held for the past sixteen years. W. S. Wolcott has been appointed acting superintendent of the Salem division to succeed Mr. Page.

MR. ABRAM Q. GARRETSON, of Jersey City, who has just been appointed by Governor Voorhees to fill the vacancy caused by the death of Justice J. H. Lippincott, in the Supreme Court, has resigned from all the corporations of which he is a director. Among them are the North Jersey Street Railway Company, Newark Passenger Railway Company, and Newark Plank Railroad.

MR. J. D. NEWTON, who has been a division superintendent of the Washington Traction & Electric Company, of Washington, D. C., since the purchase by the company of the Anacostia road, has resigned. Mr. Newton has been engaged in street railway work in the District since 1888, and was the superintendent of the old Anacostia street car line for years. When the Anacostia road was purchased by the Washington Traction & Electric Company Mr. Newton was made division superintendent of the Congress Heights, the Anacostia and the Belt lines. He was transferred from the Anacostia division to the City & Suburban line in the same capacity a short time ago.

MR. E. C. FOSTER, vice-president and general manager of the Lynn & Boston Railroad Company, has just been appointed general manager of the Massachusetts Electric Companies, and will perform his dual duties for the Boston office of the latter company. Mr. Foster was born in Hancock, N. H., Oct. 23, 1852. He was educated in the public schools of that town and at Appletons Academy. At the early age of fifteen he decided to enter business, and secured a position as a clerk in a grocery store. He resigned this position after a year and went into the milk business for himself. After three years of this, he resigned to accept a position as a conductor for the Lynn & Boston Railroad. He was then nineteen years old. Two years later he resigned this position and spent two years in California. On returning to the Bay State he was again appointed a conductor on the Lynn & Boston, and in April, 1883, he was made division superintendent. In 1892 he was elected general manager of the company, which position he still fills in connection with his other offices.

MR. C. D. WYMAN has resigned as general manager of the New Orleans City Railroad Company to accept a position with Stone & Webster, of Boston, Mass. Mr. Wyman accepted the management of the New Orleans property in 1896, succeeding Mr. H. M. Littell, who was manager of the lines during their equipment with electricity. Mr. Wyman gained an enviable reputation while in New Orleans, greatly perfecting the street-car service in that city, and devoting considerable time to the development of pleasure traffic. He has been a prominent figure in social events at New Orleans, and was a member of several prominent clubs, among them the Progressive Union and Boston clubs. Mr. Wyman will be employed as an expert by Messrs. Stone & Webster, who now control valuable properties in all parts of the country. He will supervise the operation of the numerous lighting and railway plants controlled by Messrs. Stone & Webster, and this work will give him a larger field of operation without being too closely confined to the small details connected with the everyday operation of railway and lighting plants. The following resolutions were adopted by the directors of the company, at a meeting held July 11, to consider Mr. Wyman's resignation:

"Resolved, That the resignation of Mr. C. D. Wyman as general manager of this road (to take effect Aug. 1 next) be accepted with regret, and that the secretary be and is hereby instructed to convey to Mr. Wyman our approbation of his efficient and faithful services in behalf of this company during the period of his connection therewith, and to express our best wishes for his continued success in his new home."

On July 18 Mr. Wyman was tendered a banquet at the West End Hotel by the officials and employees of the company, who generally expressed regret at losing such an efficient employee. Among those present at the banquet were: C. D. Wyman, general manager; Captain John G. Wood, secretary-treasurer of the company; H. J. Dressel, superintendent of trains; John R. McGivney, assistant superintendent and purchasing agent; T. H. Tutwiler, engineer; E. B. McKinney, chief engineer of the power house; C. V. Cosby, assistant, H. A. Ferrandon, auditor; Joseph Bein, cashier; T. C. Rojo, master mechanic; Max Plohm, director of amusements; W. H. Renaud, Jr., claim agent; Judge Lawrence O'Donnell, attorney, and T. Tranchina, manager of the West End Hotel. Captain Wood, secretary-treasurer of the company, acted as toastmaster, and he called upon Judge Lawrence O'Donnell to offer a toast suitable to the occasion. Judge O'Donnell, in opening his remarks, called attention to the fact that the occasion was not one for rejoicing. On the contrary, the officials should regret the cause which brought about the little dinner party. He spoke of the career of Mr. Wyman since his arrival in New Orleans, his energy, fairness and executive ability, and he concluded his remarks with a most touching and appropriate tribute to the friendship for a man among men.

C. D. WYMAN

In reply, Mr. Wyman spoke of his fellow-workers as friends. Were a novelist writing the story of his arrival, he would say that upon a dark and rainy night a lonely passenger dragged his way down a dreary street, looking for a place he could call home. This passenger came into the city as a stranger, with only the acquaintance of two or three people and a very slight knowledge of the work before him. He found a people who met him more than half way and helped him to gain a success. The office associates gave him their confidence, and he had tried to merit it. The real success of the company was, first, due to the faithfulness and honest work of the officials, and he retained for himself a very small part of the credit, for if this force had not come to his assistance there would have been no success. Men might make riches or a great name, but the accumulation of true friends was a pleasure more precious and sincere than the gaining of fame. He compared his friendship for the office force to the meeting of ships at sea, which speak and separate, but to him these friendships are like the association of a single crew whose lives have been so closely interwoven that associations are never forgotten. The shallow things of the heart murmur, but the deep feelings lie dumb, and he found this doubly so when he tried to express his sincere thanks for the very elaborate illustration of good-fellowship which he was shortly to leave. One by one he spoke to the officials surrounding the table, and to each paid some pretty tribute and expressed some thanks for some almost forgotten kindness.

The Knoxville Traction Company, of Knoxville, Tenn., is now using a new and novel kind of transfer. A park coupon is attached to each transfer, and ten of these are good for a ride on the merry-go-round, and five are good for a ride on the gravity road at Chilhowee Park in the afternoon. The transfers are not good for use after these coupons have been detached, and when they were first put in use a number of passengers had to pay an extra fare because they had been detached.

NEWS NOTES

[News notes for this department are solicited.]

LOS ANGELES, CAL.—The Los Angeles Railway Company has subscribed $5,000, and the Los Angeles Traction Company $1,000 to the fund for the erection of a convention hall at Los Angeles.

SAN FRANCISCO, CAL.—An appeal has been made by W. T. Baggett, representing the Bay & Coast Railway Company, to the street committee of the board of supervisors for passage to print of an ordinance granting the company a franchise to enter San Francisco. The route described in the application is from the county line, south of Ingleside, thence irregularly in a northeast direction to Islais Creek and thence through San Francisco and the Potrero to the Mission.

HARTFORD, CONN.—The residents of Hartford were treated to an exhibition of baseball between teams representing the Hartford Street Railway Company and the Hartford police department on July 18. Six innings were played, and the score stood 25 to 5, in favor of the police.

HARTFORD, CONN.—The employees of the Hartford Street Railway Company gave a dance at the Casino last week. Before the dance the Street Railway Band gave a concert on the green, which was enjoyed by a large number.

COLUMBUS, GA.—The employees of the Columbus Railroad Company, both railway and lighting departments, enjoyed a barbecue on July 13 tendered by President Flournay of the company. The affair occurred at Mr. Flournay's home in Wynnton, and was thoroughly enjoyed by all.

ATLANTA, GA.—As the result of a caucus between members of the City Council an entirely new electric lighting franchise has been adopted in favor of the Atlanta Railway Company. The franchise is given for a period of twenty-five years.

EAST ST. LOUIS, ILL.—An extension of time has been granted the East St. Louis Electric Railway Company to lay tracks in certain sections of the city. In consideration of the grant of further time the company agrees to pay $9,789 to the city, which amount will be returned to the taxpayers who paid for the elevation of the street. For this work the company was not taxed, as it had rails laid on the street.

CHICAGO, ILL.—The annual meeting of the stockholders of the Chicago Union Traction Company was held July 24. The old board of directors was re-elected, but the meeting of the board, for organization, was postponed until next week. The company reports the income account for the year ended June 30, 1900, as follows: Gross earnings, $7,477,398; operating expenses, $3,761,797; net earnings, $3,715,601; other income, $868,351; total income, $4,583,951; total deductions from income, $3,979,876; balance $604,076; dividends on preferred stock, 5 per cent, $600,000; surplus, $4,076. Following are particulars of traffic: Car mileage, 29,691,850; passengers carried, 20,849,562; per cent of transfer passengers, 38.71 per cent; proportion of expense to earnings, 50.31 per cent; proportion of expense to gross receipts, 45.07 per cent; proportion new income to gross receipts, 7.24 per cent.

CHICAGO, ILL.—President J. M. Roach, of the Union Traction Company, was waited upon by a delegation of seventeen of the oldest employees of the North Side street railways at his office last week. The men presented him with a roll containing the names of nearly 2000 employees, who wished to express their thanks for the recent raise in their salaries. The list was headed by the following greeting: "We, the undersigned employees, appreciate the stand you have taken in the matter of wages, and take this means of conveying to you our appreciation and to express our heartiest thanks. We wish to assure you that as far as we are concerned your efforts in our behalf will not be wasted, and the future shall prove that no man has a more loyal set of men in his employ than you have."

Mr. Roach assured the committee that he would look after the interests of the men, and do for them anything within reason. The recent rise in wages, he said, was not final. If the men should act in such a manner that a saving to the company would result, it would assuredly result in profit to them, and if at any time they had any suggestions to offer for the betterment of the service and the better care of the public he would be pleased to hear from them.

ELKHART, IND.—The Indiana Railway Company, which owns the local electric lines at Elkhart, Goshen, Mishawaka and South Bend, and the interurban line between the towns, is preparing to establish a baggage system on the interurban lines.

INDIANAPOLIS, IND.—The Indianapolis Street Railway Company has purchased both the Martinsville gas and Commercial electric lighting plants. The plans of the company, in regard to this purchase, are not known.

SHELBYVILLE, IND.—On July 17 the City Council passed an ordinance extending the franchise granted March 20 to the Shelbyville Heat, Light & Power Company 240 days. The company has experienced considerable difficulty in securing other franchises for its new line, and this has prompted the Council to grant an extension of time for beginning construction work here.

WICHITA, KAN.—Arrangements have been completed between the Wichita Electric Railway & Light Company and the promoters of the carnival for displaying similar floats on the street car lines to those which made such an impression in Milwaukee and New Orleans. The subject of the floats will not be given out until the carnival week.

LOUISVILLE, KY.—The franchise for operating a street railway on Frankfort Avenue, from the old city limits to the new limits, a distance of 5860 ft., has been sold to the Louisville Railway Company for $250.

WEBSTER, MASS.—The Railroad Commissioners are inquiring into the causes of the accident here on July 4, so as to determine who was responsible for the catastrophe.

SPRINGFIELD, MASS.—The Selectmen of Agawam, Mass., have dismissed the petition of the Hartford & Springfield Street Railway Company for permission to lay tracks in the streets of the town. The Hartford & Springfield Street Railway Company is a Connecticut corporation and recently succeeded to the rights of the Springfield & Southwestern Street Railway Company, under the charter of the Suffield & East Granby Street Railway Company, and the name of the company was changed to the Hartford & Springfield Street Railway Company by permission of the Superior Court of Connecticut.

DETROIT, MICH.—A resolution has been introduced in Council by Alderman Beamer requesting that the street railway company consider the acceptance of a new thirty-year franchise covering all lines in the city with the general rate of fare to be eight tickets for 25 cents, with universal transfers. Governor Pingree, the advocate of municipal ownership, says: "On the face of it the proposition may be considered the next thing to municipal ownership."

ST. LOUIS, MO.—It is reported that the St. Louis & Illinois Electric Railway, which wants a franchise in St. Louis, and has a bill pending in the City Council, will be a rival to the St. Louis Transit Company. It is said that it will connect with the electric and steam railways east of the river. It is also rumored that the St. Louis & Suburban will be taken into the combination.

LIBERTY, MO.—The organization of the Kansas City, Liberty & Excelsior Springs Railway Company has been perfected, and it is stated that work on the construction of an electric line between the points named will begin soon. The officers of the company are: J. S. Chick, president; Charles H. Scott, vice-president; C. B. Leavel, secretary; J. P. Bauserman, treasurer, and Charles L. Leiteh, chief engineer. Surveys are expected to be made at once to select a route. The capital stock of the company is $1,000,000.

OMAHA, NEB.—At a recent meeting of the City Council the Omaha, Council Bluffs & Suburban Railway Company was granted permission to lay several additional short lines.

EXETER, N. H.—An innovation is being planned for Hampton Beach in the shape of Sunday services to be held in one of the Exeter, Hampton & Amesbury Street Railway Company's buildings. A prominent religious worker has broached the subject to Superintendent McReel, and he has granted the free use of the building and the piano to any clergyman who desires to start the movement.

CAMDEN, N. J.—The Camden & Suburban Railway Company has made application to the Council of Riverton for permission to construct an electric railway on Broad Street, in that borough, to connect with the company's line in Palmyra, and with the lines of the Camden & Trenton Street Railway Company. The Council has decided to consider the application on Aug. 9.

BROOKLYN, N. Y.—Alfred R. Goslin, Charles Thomas Davis and Eugene L. Packer, who were convicted recently of conspiracy to "bear" the stock of the Brooklyn Rapid Transit Company, have obtained from Justice Bischoff, in the Supreme Court, a certificate of reasonable doubt as to the legality of their conviction, in order that an appeal might be taken. Justice Bischoff fixed bail for Goslin, who was sentenced to six months in the penitentiary and to pay a fine of $500, at $12,000; and for Packer and Davis, who were each sentenced to three months' imprisonment and a fine of $250, at $5,000 each.

NEW YORK, N. Y.—A Third Avenue trolley car became unmanageable in Park Row July 18, and smashed into the rear platform of a horse car of the Dry Dock, East Broadway & Battery line. The platform was squashed like a crushed strawberry box, the car pitched onto the sidewalk and two passengers painfully bruised. A wheel was taken off a wagon standing nearby, and the driver was thrown into the street. The collision threw the horses of the horse car against an electric car in front, and one of them was crushed to death.

BROOKLYN, N. Y.—An accident occurred on a siding of the Kings County Elevated Railroad at Georgia Avenue and the Eastern Parkway July 17, in which three empty cars were hurled from the track into the street and wrecked. The accident was caused by some misplacement of the switch.

BROOKLYN, N. Y.—At 6 p. m. on July 19 the Rockaway express of the Long Island Railroad ran into the Bay Ridge elevated train on the Fifth Avenue branch of the Brooklyn Elevated near the Fulton Street station, killing the motorman and injuring several passengers. The Bay Ridge train was stalled, owing to the fact that the fuse on the rear car burned out, and no warning was given to the Long Island train, which followed at a headway of five minutes. None of the injured were seriously hurt.

ALBANY, N. Y.—At the annual meeting of the stockholders of the United Traction Company, held last week, the retiring officers were re-elected, and in addition J. W. McNamara was elected second vice-president. The directors also declared a regular quarterly dividend of 1¼ per cent, payable Aug. 2. The total earnings for the six months ending June 30 are $640,000, considered a handsome showing for the first half year of the new consolidated company. On the basis of these figures the aggregate earnings for the year are placed at $1,400,000.

STATEN ISLAND, N. Y.—Thirty passengers in a trolley car of the Staten Island Midland Railroad Company's line jumped or were thrown in a heap upon a macadam roadway at Concord, S. I., on July 17, and many were hurt. The car was descending a short but sharp grade in Richmond Road when it left the rails. It jumped a deep gutter, climbed the bank at the right side of the roadway, just missed a big telephone pole and crashed through a high board fence. The car ran diagonally up the embankment and when its impetus was checked settled back and careened toward the roadway, almost overturning. The passengers, men, women and children, were badly frightened, and as the car threatened to overturn they jumped or were thrown out into the roadway.

Street Railway Journal

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RECENT IMPROVEMENTS IN THE SOUTHWEST MISSOURI ELECTRIC RAILWAY SYSTEM

Since the publication of an article on this system, in the STREET RAILWAY JOURNAL of May, 1899, extensive improvements have been made, which warrant a rediscussion of this interesting interurban proposition. About $300,000, raised by second-mortgage bonds, has been expended during the last year on extensions, double tracking, new car houses, and particularly on a new power plant and complete polyphase system of distribution with rotary converter sub-stations.

The line of the Southwest Missouri Electric Railway Company connects and runs through the cities of Joplin, with a population of 30,000; Webb City and Carterville, with a combined population of 15,000, and Carthage, Mo., with a population of 12,000, and Galena, Kan., with a population of 15,000, by far the greater part of its traffic being interurban. The country through which the road runs is highly cultivated farming land on the surface, thickly dotted with the head houses of the zinc mines for which Joplin and Galena are noted. These mines employ many men in their underground workings. This unusual double occupation of the land gives a correspondingly large passenger traffic. The line is 31 miles long, about 20 miles of which is on private right of way, 50 ft. in width. The roadbed is laid out on standard steam railroad plans, the rails being laid on 6-in. x 8-in. x 8-ft. oak ties, laid 2 ft. between centers. All the new rail is 60-lb. T, made by the Pennsylvania Steel Company, in 60-ft. lengths.

The line is favorably situated with regard to securing ballasting material. The piles of tailings from crushers of the zinc mines, between which the road twists and turns in places, consist of a coarse, dustless, crushed flint rock, which makes as good a ballast as broken stone. It drains nicely and weeds do not grow upon it. The line is shouldered and ditched through the cuts. Of the total length of about 31 miles, approximately 8 miles are double tracked, nearly all of this double tracking having been put in during the last year; the double-track sections are being extended as rapidly as circumstances will permit. The line is laid out to obtain as long tangents as possible,

CAR HOUSE AT WEBB CITY, SHOWING STANDARD TYPES OF CARS

grades being permitted to avoid curves to a greater extent than in steam railroad practise, as electric cars—if supplied with good voltage—can go over the grades without difficulty, while curves necessitate slowing down and introduce greater possibilities of accidents. The speed

EXTERIOR OF POWER STATION

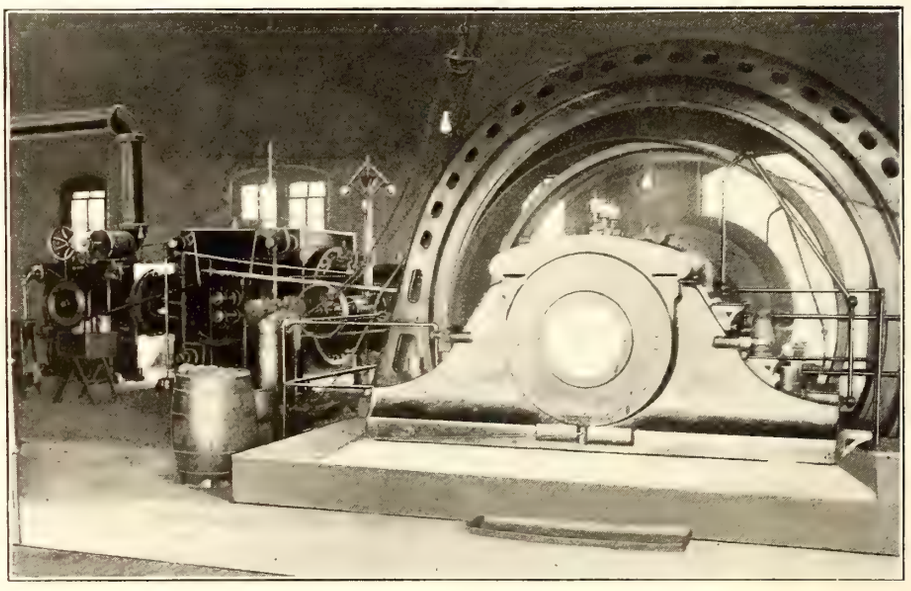
obtained is consequently comparable with that of steam lines.

From Joplin to Carthage, Mo., a distance of 19 miles, there is run what is termed the "Empire County Express." This car makes four intermediate stops for passengers and five stops for railroad crossings. It is scheduled to run 19 miles, with a total of ten stops, in one hour, and makes the schedule with great regularity. This express runs at intervals of one hour and a half, there being six local cars at thirty-minute intervals between the expresses, thus giving frequent service. The local cars take nearly one-half hour longer than the express to make the run, so that an express starting five minutes ahead of a local nearly overtakes the local ahead before reaching its destination. In the other direction, from Joplin to Galena, a twenty-minute service is given.

The rates charged are about 1 cent per mile, the fares being 10 cents from Joplin to Galena in one direction, or Webb City, in the other, and 10 cents from Webb City to Carthage. A book of one hundred 5-cent fares is sold for $4.50. There is being waged a sharp competition by the steam road operating between the same points, which is now giving the same rates as the electric line. Some freight is carried on the front platforms, but no effort is made to obtain it. Between Joplin and Carthage, 19 miles, which the Empire County Express (electric) makes in one hour, the steam road is scheduled to run in fifty minutes. The steam road, however, is handicapped by its inability to reach the business centers. In Carthage, as well as in Webb City, a free bus is operated by the steam road, which enables passengers to get to and from the trains. The frequency of the steam service is two hours from Joplin to Carthage, as compared with every hour and a half on the electric express and every thirty minutes on the electric locals.

Eighteen cars are usually in operation, all of which are double truck, there being no value in single-truck cars for this class of service. The cars have unusually wide bodies, 8 ft. x 4½ ins. maximum, and an exceptionally large amount of steel in their framing, as called for by the rigid specifications, a reprint of which will be found on another page of this issue. The cars have cross seats and smoking compartments in most all cases. The cars were made by the Laclede Car Company and Jackson & Sharp, and are mounted on Brill No. 27 G and Jackson & Sharp trucks, some Peckham trucks being also used. No small-wheel maximum-traction trucks are used, owing to the comparatively easy riding of the uniformly sized larger wheels and the high speed. The cars are equipped with two motors each, Westinghouse 38 B and General Electric 57's being used, geared up to 31 miles per hour at 500 volts; they get, however, about 600 volts. The weight of each car is kept down to about 18 tons, so that two motors can handle the work easily. Sufficient maximum-traction effect is obtained by overhanging the motor at one end of the truck, instead of mounting it between the wheels.

The cars are fitted with Wagenhals' inclosed arc headlights. These headlights are adjusted for 6½ amps., and throw an astonishingly brilliant searchlight beam along the track in the dark country districts. Their use is found to be of great benefit in reducing the number of cattle killed at night, the brilliant beams of light serving not only to show up cattle on the track, but to frighten them away. While without the arc headlights more cattle were killed during the evening than during the day time, this condition is now reversed. The head-lights do not seem to frighten horses, as might be expected. The head-lights are wired in the motor circuits, thus obtaining their current through the circuit breakers, with which every car is provided. To avoid blinding the motorman of an approaching car, the lights are turned off by tripping the circuit breaker and pulling out the plug which supplies current to the light. In this way arcing at the plug is avoided. Curtains are drawn in the front doors of the cars to darken the platform and further enable the motorman to see ahead on the track.

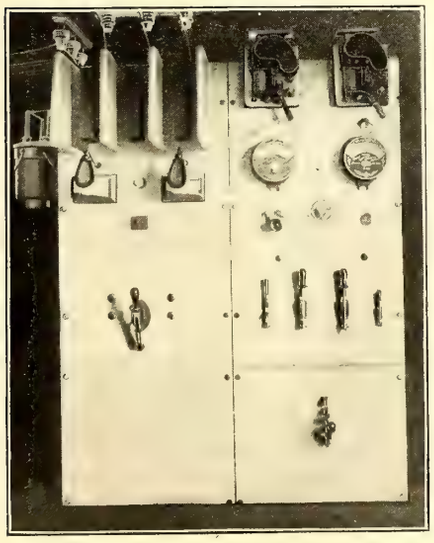


INTERIOR OF POWER STATION, SHOWING 1200-HP UNIT

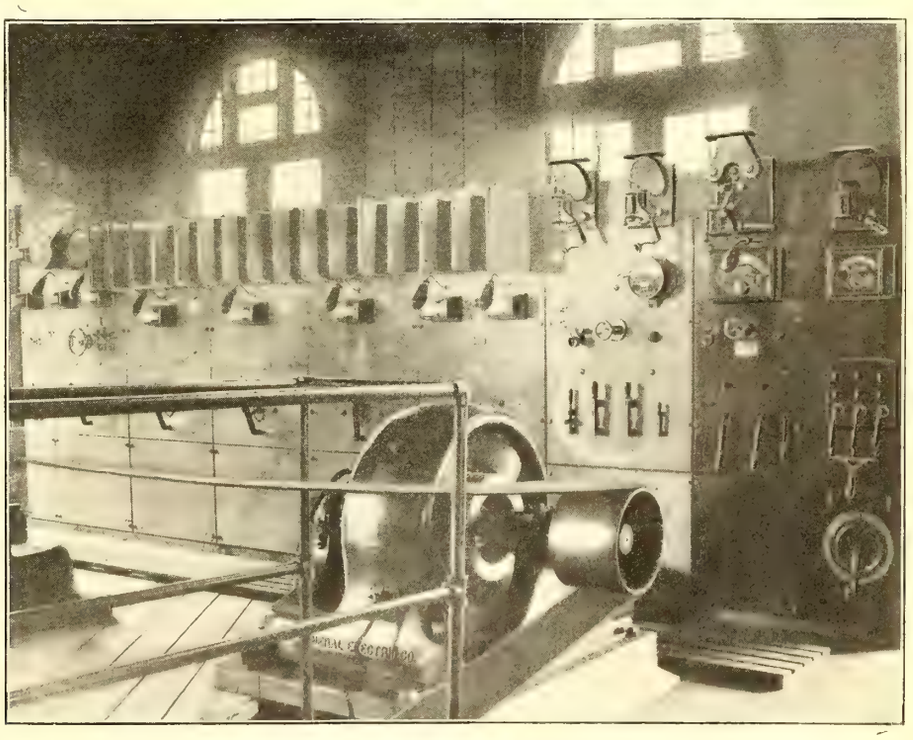
The work on the new power plant was begun in September last, previous to which time the road was operated by two direct-current plants, the long feeds being carried by means of boosters. The polyphase equipment was first put in service April 25. The direct-current apparatus was

very heavily loaded, and in spite of this fact the new polyphase generating system was set up in place of old engines and generators in one of the existing plants, new boilers were installed in the places occupied by the old, and service was maintained while the changes were being carried out. This was almost as difficult an undertaking as the alleged proposal of a Southern Board of County Commissioners to erect a new court house in place of the old, to use the materials of the old in the construction of the new, and to occupy the old house until the new one was finished. The power house not changed over is now maintained as a reserve, but is not operated, the polyphase system carrying the whole load. In laying out the polyphase system the rather unusual principle has been followed of putting in no reserve units in the original installation, thus making all machines of as large a capacity and of as economical a size as possible, future extensions being depended upon to call for duplicate and reserve machines. Thus the original installation has only one engine, one generator, one exciter, one high-tension line in each direction, and one rotary converter in each sub-station. The adoption of such a policy in place of the usual use of at least two, and generally three, units, common until lately, speaks well for the improvement in reliability and freedom from shut down of power-house machinery. The new generating equipment consists of one tandem compound horizontal Cooper-Corliss side-crank engine, rated at 1200 hp, driving at 95 r. p. m. one 32-pole, 25-cycle, revolving-field three-phase generator. To avoid oscillations and hunting of rotary converters with a single-crank engine, there is fitted to it a 55-ton fly-wheel, 18 ft. in diameter, with a cast iron rim having a cross section 18 ins. square. The engine is guaranteed to use no more than 14 lbs. of steam per ihp-hour at its rated load. The generator, as well as the whole of the polyphase equipment, was built by the General Electric Company. The generator is wound to deliver the full high-tension pressure of 11,000 volts directly from its windings, thus doing away with the need of step-up transformers. It is rated as able to carry 750 kw with a 90 per cent power factor, *i. e.*, it will carry its full rated output of 750 kw without overheating, even if the current lags behind the e. m. f., due to reactance in the circuit, to such an extent that the current is necessarily increased 11 per cent above what would be necessary with a non-inductive load. The generator is guaranteed to carry its rated load continuously with a temperature rise not over 40 degs. C. above the air at 25 degs. C., and to carry a 25 per cent overload for two hours with a temperature rise not exceeding 50 degs. C. The guaranteed efficiencies are 95 per cent at full load, 94 per cent at three-quarters load, and 92 per cent at half load. The

TYPICAL INTERURBAN TRACK VIEW



SUB-STATION SWITCHBOARD



MAIN STATION SWITCHBOARD

guaranteed regulation is a rise of voltage of 8 per cent on throwing off full non-inductive load.

Three new double-decked Cahall boilers, each rated at 450 hp, have been put up with chain-grate stokers built by the makers of the boilers—the Aultman-Taylor Company. Coal and ash handling apparatus, coal bunkers and a new

INTERIOR OF SUB-STATION

chimney will be built later. Good feed water is obtained from a driven well 825 ft. deep, in which the water rises to within 75 ft. of the surface, from which level it is raised by a deep-well pump. Otherwise, it is a difficult matter to obtain good feed water in this locality, as the mines discharge considerable acid into the stream. A Cookson feed-water heater is used. The engine exhausts into a Worthington condenser, the water for which is cooled in

TYPICAL SUB-STATION, COMBINED WITH RESIDENCE OF ROTARY ATTENDANT

a Worthington cooling tower of the forced-draft type. This tower, which appears in one of the illustrations, is 17½ ft. in diameter and 34 ft. high, built of boiler plate, and is guaranteed to handle 21,000 lbs. of steam per hour, giving a vacuum of 24 ins. to 26 ins. The 108-in. fan of the cooling tower is driven by an old S. R. G. 30 motor, with suitable gearing.

The switchboard of the generating station is of the usual General Electric high-tension form, with type G oil switches and spring-expulsion type fuse holders. General Electric electrostatic ground detectors are used, connected in series with carbon rod resistances to prevent a short circuit in case the voltage jumps between the vanes of the ground detectors.

From the station two high-tension feeders run out in opposite directions along the track, as indicated in the wiring plan. One of these is of No. 4 wire as far as the first sub-station and No. 6 wire the remainder of the distance to the second sub-station in the same direction; the other is No. 6 wire from the station to the only sub-station in that direction. The high-tension lines are carried on Locke 5½-in. triple-petticoat insulators on the poles which support the span wires. The high-tension wires are on one side of the road, clear of the feeders and telephone line, which are kept on the other. The central power station itself contains a sub-station equipment, thus making four sub-stations altogether. Two 0000 feed wires are

MAIN OFFICES OF COMPANY

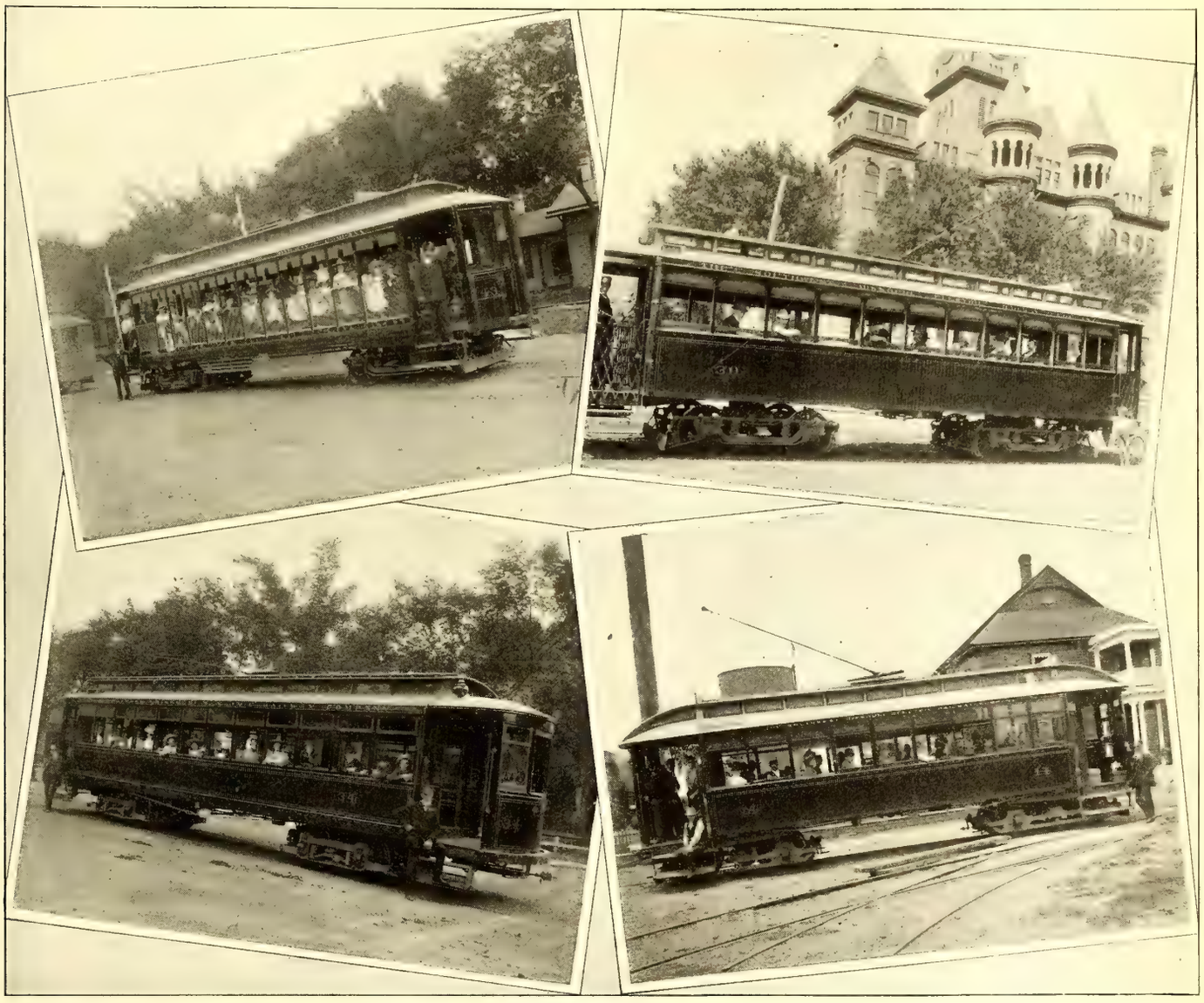
carried throughout the whole length of the line as a sort of side feeder. The company now has considerable unused feed wire on its hands, owing to the greatly reduced amount of copper necessary with the new system feeding 500-volt lines at all points. In front of the central power station the trolley line is divided by section insulators and the 0000 feed wires going to each direction are brought into circuit breakers on the board, so that either half of the line can be shut down and service continued on the other half in case a wire is down or there is a heavy thunder storm on one section. The sub-station switchboards are also fitted with two feeder breakers, so that the electrical continuity of the line can be interrupted for the same purpose in front of the sub-stations by putting in section insulators if at any time it is found desirable.

The sub-station equipments are in all cases the same. The apparatus consists of one 250-kw rotary converter supplied by three 80-kw oil-insulated, oil-cooled, step-down transformers, thus doing away with blowers and their motors, which are necessary with the forced-draft type of transformers. No copper bridges or equivalent devices for reducing hunting are used on the rotaries, although they are supplied from a single-crank engine running at only 95 r. p. m. In spite of this, there is no

trouble whatever from hunting, the alternating ammeters showing only the slightest perceptible beat in time with the engine strokes. Although the rotaries are rated at 417 amps., 900 amps. have been drawn from one of them for a short period without sparking and without overheating. The rotaries are compound wound, and, with the exception of the machine in the central power station, are oil insulated and air cooled. Reactive coils have been put in the alternating circuits to give the proper compounding.

The method of starting the rotaries is as follows: When starting up in the morning the main generator is run up to about half voltage, and the rotary in the main power station is thrown on and started up by the induction motor rheostat switch is installed on each rotary switchboard for this purpose.

The sub-stations are attractive appearing structures of the style illustrated herewith. The interior is largely given over to the living quarters of the sub-station attendant and his family. By combining the residence and the sub-station proper in this way but one man is needed per sub-station, as other members of his family are capable of watching the apparatus in his absence. The one room devoted to the electrical apparatus is provided with a double door sufficiently wide to accommodate the rotary, and the sub-stations are so planned that this room can be extended when more machines are needed.



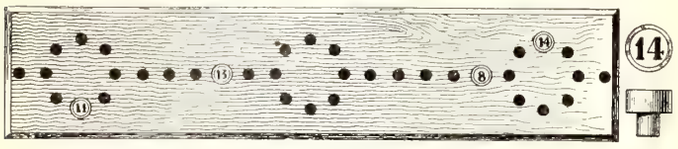
STANDARD OPEN AND CLOSED CARS

action of the alternating currents; that is, by the method usually adopted with General Electric apparatus; the half voltage of the generator serves the same purpose as compensating transformers, reducing the alternating voltage impressed on the collector rings of the rotary down to about half the normal. When synchronized and brought up to full pressure, the direct-current end of the power-station rotary is closed on the 600-volt lines and the sub-station rotaries are started from it by means of direct current sent out over the trolley wires and 0000 side feeders, which, as noted above, are continuous from station to station. In this way the sub-station rotaries are brought up to speed without using alternating currents. A four-step

Among the other extensions during the last year are the new car house and shops, a view of which appears herewith. This building has a frontage of 143 ft. and is 200 ft. long, affording accommodation for forty cars. It is located just across the track from the power station and general office in Webb City. In it the cars are cleaned and all repairs are made. The company does not allow the use of any water in cleaning its cars, Modoc liquid car cleaner, made by the Modoc Soap Company, of Cincinnati, Ohio, being used exclusively.

A view of the general office of the company is also given. The lower floor contains the usual general offices, and the upper floor the dispatcher's office, the dispatching being

done, as usual, by means of a telephone line with bridging stations of the police-patrol type. The phone dispatcher has in front of him a board with holes arranged as in the accompanying sketch, in which he can insert buttons numbered to represent the cars, so as to keep track of their locations on the line.

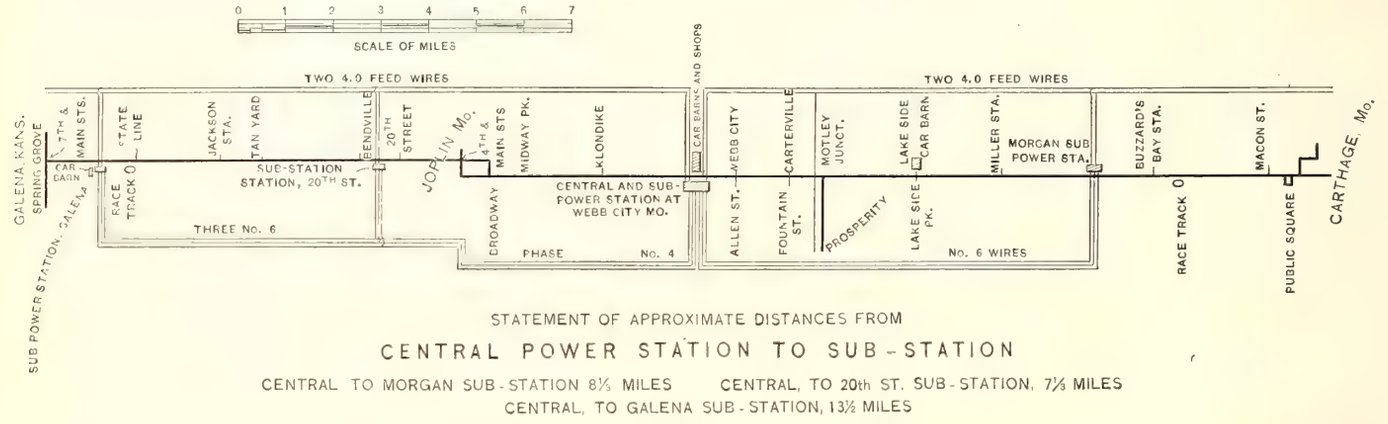


BOARD USED BY TRAIN DISPATCHER FOR RECORDING LOCATION OF CARS

Another interesting point about the operation of this system is the method of paying the men. The rate paid conductors and motormen is 12½ cents per hour during the first six months, after which 15 cents is paid, with an addition of what is termed a "10 per cent dividend," *i. e.*, each man is paid at the end of six months a further sum equal to 10 per cent of his total wages during the previous six months' period. In this way the amount actually paid is 16⅔ cents per hour, provided a man does not leave during the six months.

On July 4 the company made an innovation which perhaps is worthy of mention. On that day it was decided to dispense altogether with the use of fare registers. Instead, each conductor reported the amount of cash he had on hand in the morning of the 4th, put in the entire day and a good part of the night in collecting fares, not registering any of them, and then turned in amount of cash on hand at close of business, less amount he started with in the morning. The experiment was successful, and the total receipts for the day were $530 in excess of any previous day in the history of the road. One conductor turned in $196.20, which is the record for the road; all of this was collected from one car with no trailer.

The Southwestern Missouri Electric Railway Company is capitalized at $800,000, all of which is issued, and has an authorized bond issue of an equal amount, of which $750,000 is issued, the bonds drawing 6 per cent and being redeemable inside of three years. The receipts for the month of May, 1900, the last month previous to the writing of this article, amounted to $22,593, of which the operating expenses, including paving, car licenses and legal expenses, amounted to $9,647, leaving a net income of $12,946. The interest on the bonded indebtedness amounts to $3,750 per month. Occasional dividends have been paid in the past, and from now on regular dividends will be paid, although at the time of this writing the amount of these dividends was not decided. The stockholders of the road are identical with the bondholders, and are largely residents of Harrisburgh and Philadelphia, Pa. The road has an Eastern office in the former place.



STATEMENT OF APPROXIMATE DISTANCES FROM

CENTRAL POWER STATION TO SUB-STATION

CENTRAL TO MORGAN SUB-STATION 8⅕ MILES CENTRAL, TO 20th ST. SUB-STATION, 7⅕ MILES

CENTRAL, TO GALENA SUB-STATION, 13½ MILES

HEAD HOUSE OF ONE OF THE MANY ZINC MINES ALONG THE ROUTE

The president and treasurer of the road, A. H. Rogers, manages its affairs, taking personal charge both of its larger and more important dealings and the many details of operation. To President Rogers is due the credit for the road's good equipment, successful operation and pros-

perous condition. The other officers of the road are as follows: E. J. Pratt, superintendent motive power; C. E. Baker, superintendent transportation; J. M. Maret, superintendent tracks, lines and bridges, and H. T. Morrison, superintendent repair shop.

The Street Railway System of Geneva, Switzerland

The beautiful city of Geneva, situated at the western end of Lake Leman, has of late become more than usually interesting to the American tourist and engineer, by reason of the remarkable change that has been made in its street railway system. In view of the size and importance of the city and the extent to which all the facilities for travel are liberally patronized, it is a little curious that the initiative in the new work should have come from outside; but this has also occurred elsewhere in Europe. Geneva was early in the possession of steam tramway and trolley roads, but it has been reserved for foreign capitalists to unify the existing systems, create a most extensive network of new lines, and to develop plans which comprise not only the whole canton, but all the adjacent country in Switzerland and France that is physically part of Genevese territory. The past month has witnessed the completion of a large part of the enterprise, giving, therefore, an opportunity for presenting the work and its history in more or less appropriate detail.*

BRIDGE OF MT. BLANC, AN ARTERY OF STREET RAILWAY TRAVEL, GENEVA

It would appear that about three years ago H. E. Butters, of San Francisco, prominently identified with Californian and South African mining interests, was very much impressed while passing through Geneva on a tour, with the fact that the street railway service was not adequate to the population, and that with abundant cheap water power in the city itself, the methods employed depending largely on steam "dummies," were intolerably behind the times. The idea immediately suggested itself to Mr. Butters to effect improvement by consolidation and the injection of new capital. Steps were at once taken to this end, outside capital was readily enlisted on a rough presentation of the plan, and ultimately control was obtained of the Narrow Gage Street Railway Company (Voie Etroite) of Geneva, with nearly 45 miles of track in the city and suburbs, and of the General Company of Swiss Tramways (Compagnie Générale des Tramways Suisses), operating about 22 miles of track in the best parts of the city. The parties thus becoming interested, namely, the General Tramways Construction Syndicate, Ltd., of 43 Threadneedle Street, London, also secured a federal charter for the Genevese Company of Electric Tramways (Compagnie Genevoise de Tramways Electriques), and with it concessions for new lines of nearly 18 miles in and around the city and some 14 miles in extensions each side eastward of the Lake of Geneva to the charming suburbs of Versoix on the Swiss shore, and Hermance, at the French border. The Compagnie Genevoise has already done a large part of its work in welding together the system thus created, which serves a city of about 100,000 souls; a canton with a population of 120,000 and an area of 109 square miles, and which is reaching out necessarily to annex or associate with itself lines that ramify in every direction in territory hitherto dependent chiefly upon slow and expensive steam locomotion. A map is shown herewith of the Genevan network of the company, presenting graphically the manner in which, with an expenditure when all is done of about $5,000,000, the old and new lines thus consolidated and amounting to nearly 100 miles will cover the city and its suburbs, and will furnish a first-class modern system with all the improvements that the most skillful engineering can suggest.

It was natural that those who had undertaken this great enterprise should look to America for the expert ability to direct and supervise the expenditure of their money, and thus it came about that Stephen D. Field, so well known in the United States, not only as a brilliant inventor, but as one of the oldest electric railway engineers in the country, was invited to take the position of engineer-in-chief. This he consented to do, and associated with himself A. Kundig, a young Swiss engineer, who had had considerable experience in America. Under the vigorous and efficient management of these two men an amount and quality of work has been done in a manner and at prices

* Illustrated articles on street railway work in Geneva appeared in the STREET RAILWAY JOURNAL for February, 1897, and November, 1898, and they contain detailed information as to the older systems which it is not necessary therefore to repeat here.

that are simply amazing, and it may fairly be questioned whether there is in all Europe a system that has been more liberally, yet more economically, constructed. Preliminary to any attempt to consolidate car houses, rolling stock, etc., the Compagnie Genevoise determined to establish its own headquarters, and this it has done at a most picturesque part of the city, in the southwest, at a point called La Jonction, just where the blue Rhone from Lake Geneva and the arrowy, turbid Arve, from the Mount Blanc ranges, mingle their waters and flow southward to the Mediterranean. Herewith are shown views of the property and buildings, with a plan of the offices, car house and machine shop, as at present developed. The company owns at this spot about 20,000 sq. m., and thus has ample provision for the inevitable growth. As a matter of fact, this little real estate investment has proved one of the best of the concern's many shrewd moves, for the river detritus taken out and crushed electrically for roadbed material has pretty well covered the price. As is usual in Europe, the office building is a handsome, substantial edifice. It is three stories in height, with clock tower, and is built of a rich French white stone, upon which ornamental carving has been freely bestowed. It has a frontage of over 115 ft. and a depth of nearly 120 ft. in an L shape. The ground floor is devoted to the offices for cashier and bookkeeper and general accounts, and to an

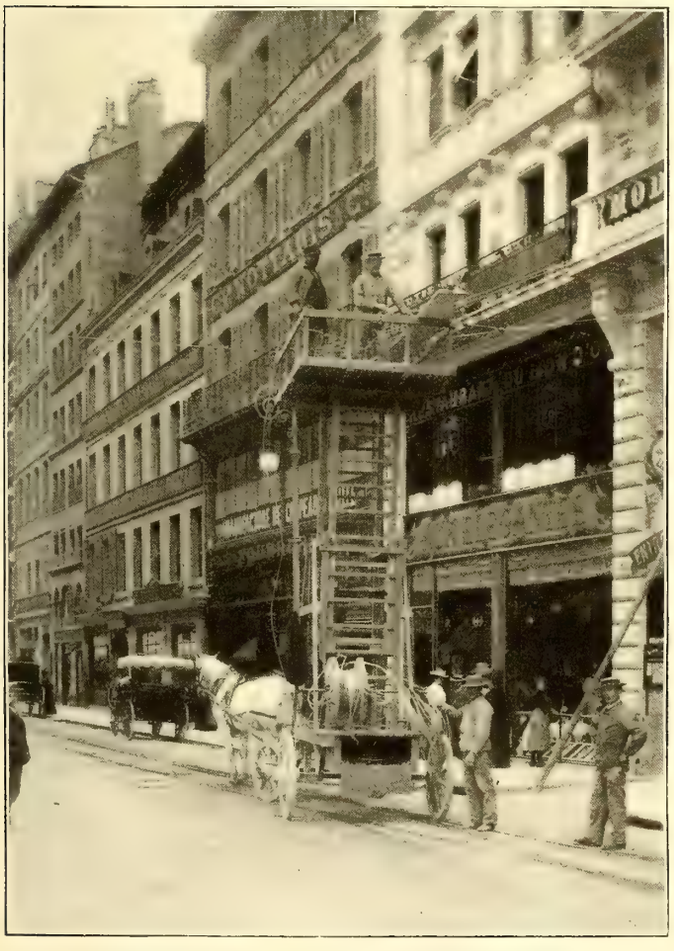
LAYING TRACK ALONG ROUTE D'HERMANCE, NEAR PARK DES EAUX VIVES

LA JONCTION, HEADQUARTERS OF THE CIE. GENEVOISE DE TRAMWAYS ELECTRIQUES

CHEVRES POWER STATION, GENEVA

assembly room for the motormen, while the long wing of the building carries a large stock of supplies, for which there is also a commodious basement. The first floor is occupied by the management, with rooms for the superintendents and various officials, and a large board room for the directors and receptions. The second floor is reserved for the engineering department, and has excellent light, and there are also a salon, bath, dormitory, etc. In the clock tower an archive room for files, etc., has been placed.

Closely adjoining the office building is the car house, of steel and brick construction, the face of the bricks being covered with hard cement. It is about 275 ft. long by 80 ft. wide, has six tracks, and can be added to indefinitely as to width. It will now carry fifty 18-ft. cars, and the pit has been made clear across the lower end, so that no switching is necessary to get cars over it. Immediately in the rear is a fine machine shop and repair shed at right angles to the car house, with one of its sides on the bank of the River Rhone. It is of the same general construction as the car house and is nearly 200 ft. long by 60 ft. wide. It is equipped with a 15-ton traveling crane and the necessary complement of tools. The yards outside the buildings



RUE DU RHONE, OVERHEAD CONSTRUCTION

constitute a depot for heavy material, such as poles, rails, road material, etc.

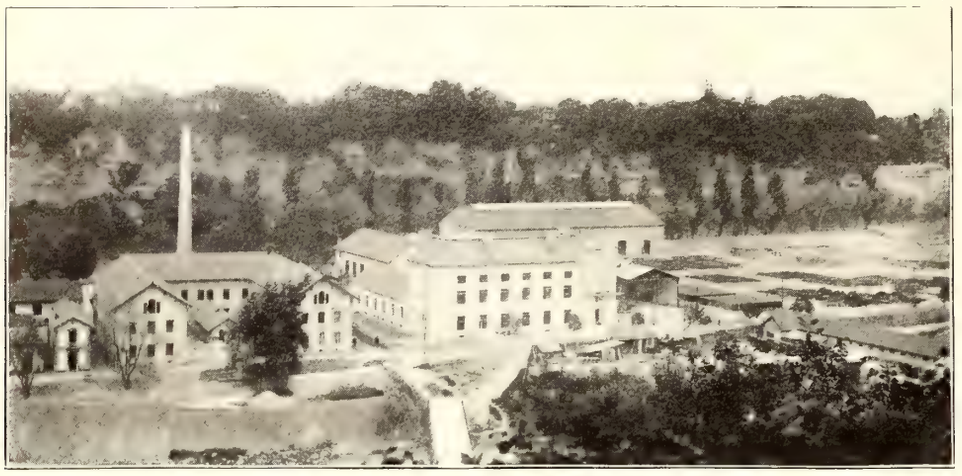
It is probably well known that the gage of street railway favored in Switzerland is only 1 m. (3 ft. 3 ins.), called the Voie Etroite. In Geneva, when the new company came into power, there were about 45 miles of such gage in the city in operation and about 18 miles of medium gage. All the new work is of 1-m. gage, which, of course, becomes therefore the standard of the whole system. Mr. Field and his staff are thoroughly well satisfied with this width, which has its advantages in view also of the narrowness of many of the streets traversed, and Mr. Field has even worked out a novel type of car known as the Hotel de Ville, from the section in which it will run and which is intended to go through narrow streets rather than wreck or abolish the existing architecture. It is only 1.70 m. in width, seats

LAYING CONDUIT ALONG ROUTE D'HERMANCE

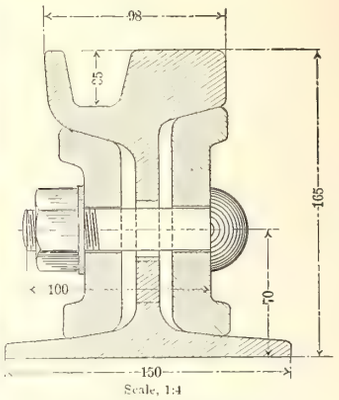
eighteen people, and provides standing room for eight more. But the standard size of car, which will doubtless be generally adhered to, is 2 m. (6 ft. 6½ ins.) in width over all, although it can be made 2.20 m. (7 ft. 2½ ins.) and keep within the official requirements and conditions. The company has thirty-six existing cars and is adding ninety new ones, for the electrical equipment of which Westinghouse motors and controllers will be used, of the familiar type. The new cars are being furnished by the Societé Industrielle Suisse, of Neuhausen, Schaffhausen, and some were equipped by the Basle works of the Allgemeine Elektricitäts Gesellschaft. The charter of the company, it may be fitly mentioned here, requires broadly that all materials and supplies used shall be preferably of Swiss origin or bought through Swiss houses. The engineers of the road are very much in favor of the Brill type of car, as used in California and also at Capetown, and one of these was actually imported by special permission to serve as an object lesson to the Genevese, who have been very enthusiastic about it, and apparently would like all the rest to be of the same comfortable and commodious model. Each car has two 25-hp motors, with ordinary controller, and is furnished with two series of five incandescent lamps of 110 volts, and is heated in addition with the McElroy electric heaters of the Consolidated Car Heating Company, of Albany, N. Y.

The rail used by the Compagnie Genevoise is the Phœnix, model 18 C, furnished by the firm of Demierre & Company, of Geneva. It is shown herewith in cross section, and has a weight for city use of 105 lbs. For country

lines the Phœnix model 5 F is used, with a weight of between 65 lbs. and 70 lbs. All the angle-plates have three bolts on either side of the joint, and the Edison-Brown plastic bond is used, with three or four 00 copper wires at



OFFICE, CAR HOUSE, ETC., AT LA JONCTION



STANDARD SECTION OF RAIL

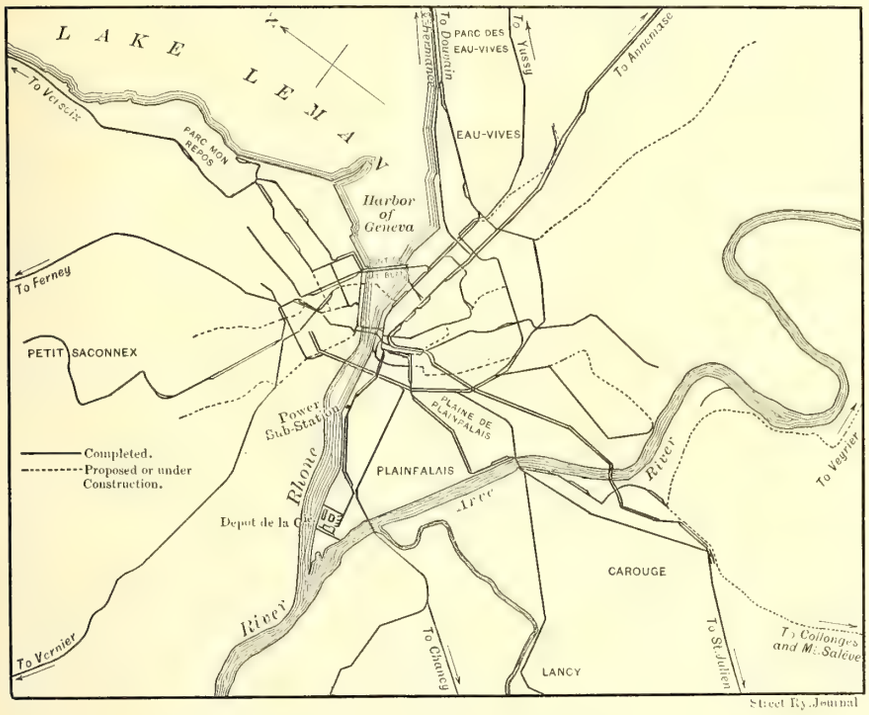
crossings. The nature of the track and roadbed construction can be seen from the views presented. All the track in the city is carried on concrete girders, with a height of 12 ins. and a breadth of 10 ins., while the total depth of masonry under the track is 1 m. This solidity is not only due to the fact that the bed has to stand the crushing strain of the city's 15-ton road rollers, but because the streets are generally dug out of slimy clay soil, which has a mean trick of caving in, so that special stability was the best means of guarding against disruption. Rigidity of the rails in relation to each other is also insured by the tie-rods, of which there are five to each length of 12 m., or, say 40-ft. rail. The radius of curves is 11 m. at La Jonction and 15 m., 18 m. and 20 m. in other parts of the city.

The entire new network of feeders is distributed by means of terra cotta conduit, which Mr. Field has had made specially in Switzerland for his work. It starts out from the city power plant at Coulouvreniere, from which current is taken under conditions that will be touched upon later. The unit of conduit is a two-duct piece, 70 cm (29½ ins.) in length, each duct having a 2½-in. bore. These pieces are laid edge to edge and bound with tar paper, as shown in one of the illustrations, and they are then grouted 10 cm (4 ins.) on all sides, making a solid, impermeable, yet easily accessible, system. In some places, as in the main thoroughfare, the Rue du Rhone, the conduit is under the track. The number of ducts varies from place to place, according to the requirements, being twenty in the section across from the power house to the Plaine de Plainpalais, and twelve, eight, six, four, etc., in other parts of the city. The system is reached by means of one hundred manholes, all of good size, the largest near the power house, central for the whole system, being 10 ft. cube. The cables for the work have been furnished by the Société D'Exploitation des Cables Electriques (Systéme Berthoud, Borel & Cie), Cortaillod, Switzerland. From the power plant to the big manhole, each way out, there are three cables on each side of 700,000 circ. mils each, and then smaller cables lead off for each line, according to the demand. To start up the first cars, some 12 km of 500,000 circ. mil cable had been drawn in at the time these notes were made, in the early part of the summer. In addition

TERMINUS OF MT. SALEVE RACK RAIL ELECTRIC RAILROAD, GENEVA—MT. BLANC IN DISTANCE

to this there is a four-circuit telephone cable cut at each manhole, so that from those points communication can be had immediately with the power plant, office or car house.

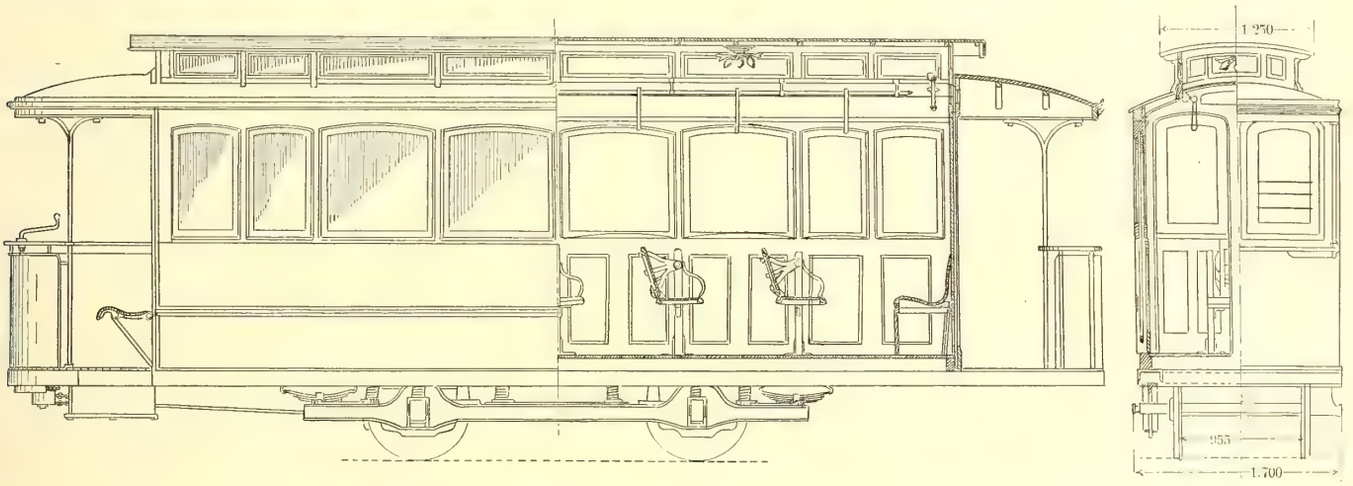
The line construction may be said to follow American practise in general so far as relates to the pole line, etc., and much of the material has been supplied by Robert W. Blackwell & Company, Ltd., of London; while some excellent insulating pieces used are from the Société Française d'Ambroine, of Paris, and other material has been supplied by the Duisburg Iron Works, of Duisburg, near Cologne. About 13 km (8 miles) of pole line have been put up. Some of the poles are made with side web, from two flat slabs of iron, drawn and welded at the same time; with 20 ft. in the single lower piece and 10 ft. in the single upper piece. In securing heavy corner poles to sustain unusual strain, Mr. Field, with characteristic ingenuity, has resorted to the device of taking a pole of large diameter, filling up the hollow space by dropping old rail down into it and then cementing the whole mass inside. The result is enormous stability.



MAP OF GENEVA, SHOWING THE TRAMWAY SYSTEM

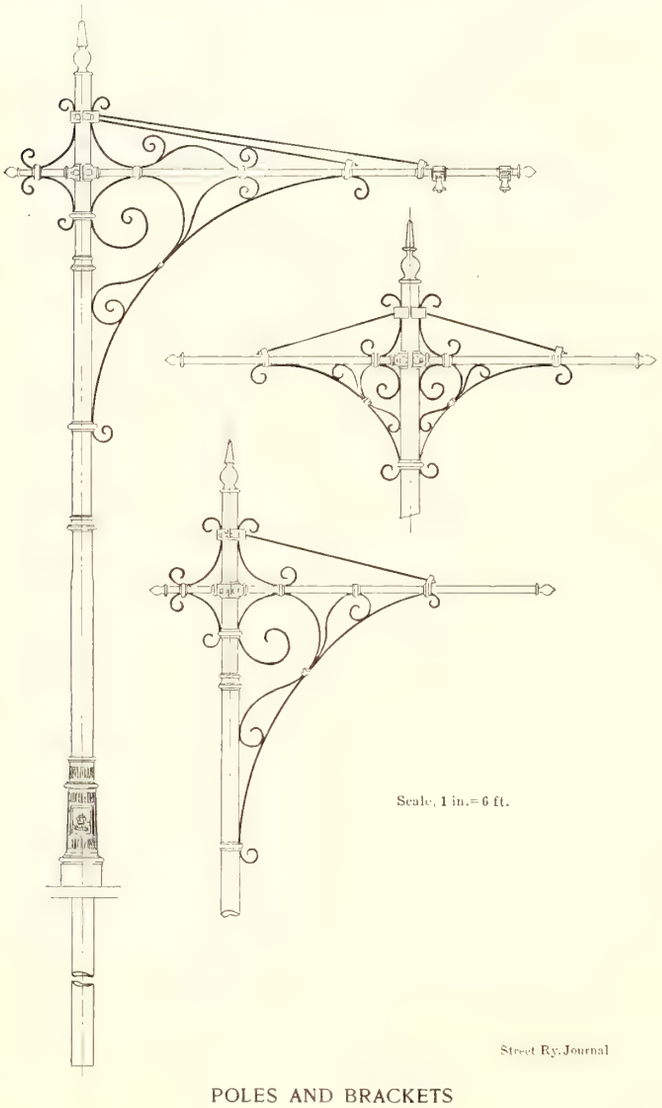
In addition to the pole line, the company has up about 15 km (9½ miles) of line fastened on buildings by rosettes, a great many of the streets being too narrow to admit poles. One of our views shows a construction gang putting up line of this type last May. The least distance permitted from wire to rail is 6 m. In the Place du Rhone there is a very interesting piece of work of this character, it being a very open space, with a cross street on one side, coming in at right angles. One long span across is 80 m. (244 ft.) at a height of 7 m. (21.3 ft.), and across the street is a parallel span of 50 m. (152 ft.) length. The span wires are composed of fourteen steel wires stranded, each 2 mm in diameter. The unusually heavy construction here was rendered necessary by the fact that a double trolley wire had to be supported for the turn-out. The end plates for this style of construction are heavy, and their pins, made of inch rod corrugated, are driven in about 8 ins.

In making his cable joints on the construction work, Mr. Field has adopted a plan which seems to be both new and meritorious. The cable to be jointed is first scarfed at an angle of 45 degs. The cut-bare ends are left separate about 1/32 in. apart and clamped in a bullet mold in which is cast very hot nearly pure tin solder. This



PROPOSED NARROW GAGE CAR, GENEVA

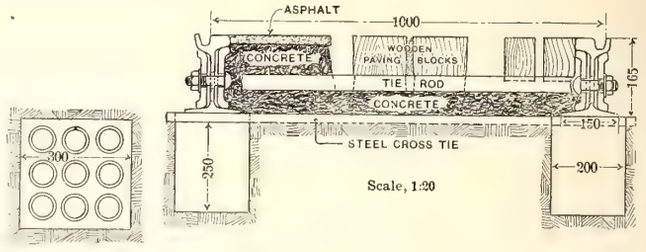
at once solders the ends of all the wires together and also the abutting ends of the cable, surrounding the whole core with an enlarged ferrule of the solder and giving the core a conductivity which slightly exceeds the theoretical. The joint thus made is then served and a sleeve of lead pipe is slipped over it. The ends of the sleeve are connected to the cable pipe by means of a cast joint made of very fusible solder. An air pump is then applied to the joint and the air exhausted until quite a high vacuum is obtained, thus testing the integrity of the envelope with the soldered ends. If when this vacuum has been obtained the joint tests out to have perfect insulation, a pot of hot



POLES AND BRACKETS

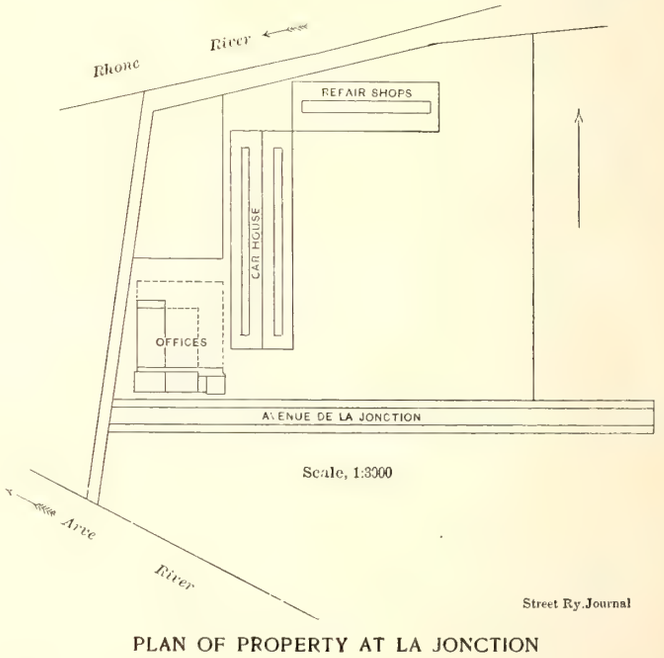
melted resinous composition is applied by a pipe leading into the joint, the opening of said pipe having been previously stopped with a wax plug. The hot compound melts the plug and the vacuum does the rest. The result of the process, Mr. Field says, is a joint of higher insulation than the normal cable itself.

The Compagnie Genevoise is relieved of all necessity of generating its own current, the city having, as is well known, developed the water power of the lake and river at its own expense and having set up a virtual monopoly of the supply, which it has been extending for some years past. The earliest plants are on the Rhone within the city itself, as in the case of the Thury plant, installed for the Tramways Suisses, as described in these pages three years ago. But the city, in 1896, having exhausted these nearby facilities, went further down the Rhone 3 miles or 4 miles to Chevres, where it established a fine Œrlikon plant for long-distance transmission to the Coulouvreniere power and pumping house, which is situated on the Rhone just above La Jonction and the property of the Compagnie Genevoise. A view is here shown of the present enlarged Chevres plant, for which we are indebted to Brown, Boveri & Company, of Baden, Switzerland, whose two-phase ma-



SECTION OF TRACK CONSTRUCTION

chines, supplied more recently, are seen in the picture. These machines have each a capacity of 1200 hp and furnish two-phase current at a frequency of forty-five periods per second at a potential of either 5500 volts or 2750 volts, at will. They are of the umbrella, vertical-shaft type, with fixed armature and revolving field, having forty-six poles carried by the cone-shaped magnet wheel. Above the machines is seen the large white marble switchboard of thirty panels and about 65 ft. in length, in the center being the three panels reserved for the service to the city, the tramways and the transformers at 2500 volts. This new



PLAN OF PROPERTY AT LA JONCTION

board was also put in by Brown, Boveri & Company, with their machines, to permit an easy manipulation of all the various units and types comprised in the plant. The current, delivered by underground cable at Coulouvreniere for the street railway work, is received at present by a 600-kw rotary on the same shaft as the generator, which in turn delivers direct current to the system at 560 volts. The contract with the city is at the rate of 12 cm, or 2.3 cents American, per kw-hour for all current up to 1,800,000 kw-hours per annum, and above that, 9 centimes, or 1.7 cents, for all current consumed. The current is delivered through meter, is available night and day, and the company's employees have access to the apparatus. The city concedes, however, to the Compagnie Genevoise the right to generate its own power, if it wishes to do so, after the quantity named above has been reached, and Mr. Field, who has had considerable experience in these matters, believes it would be worth while to do that rather than pay such

rates. It is to be hoped and expected, however, that with the opportunity to draw from such a fine plant as that at Chevres, where every increase of output must tend to reduce the cost of production materially, a basis of agreement on fair terms can readily be found. It will be understood that the cost to the company begins only at the moment when it receives the current on its own network. Examples of this plan of current supply are probably quite rare.

The Compagnie Genevoise is allowed five years for its work of construction and equipment, and the charter runs sixty-five years. It is permitted to collect a fare of 10 centimes, or 2 cents American, for the first kilometer, which is at the rate of nearly 3 cents a mile, and 5 centimes, or 1 cent American, for each succeeding kilometer. City

ENTRANCE TO EAUX VIVES

servants on duty are allowed to travel free, and there are school children rates, which do not seem to be used much. There are no transfers, and the tariff is considered such as will yield the company a fair return on its large investment.

Naturally, the American management of the road has been very much alive to the creation of new travel, and especially to the development of pleasure parks which shall induce the people to seek rational and healthful amusements by patronizing the lines. Among the parks reached by the lines are the Ariana and Mon Repos, but the most striking is that known as the Parc des Eaux Vives, at the end of No. 2 , or Hermance, line, on which were taken the views of track construction shown in this article. This beautiful resort was the homestead of Louis Favre, the famous engineer of the great St. Gotthard Tunnel, whose construction ruined him, so that the property has passed out of the hands of his family and has become one of the most picturesque resorts imaginable, with its springs, chalets, alpine groves, theater, dancing hall, etc. The possibilities of traffic in this direction may be inferred from the fact that last summer, when proper car facilities were lacking, over 250,000 people went out to this place in rough wagons. From this Hermance side of the lake a line of ferry boats run to the other side, or Versoix, where many of the wealthy have their homes, and out in which direction the Compagnie is also pushing its lines along the Swiss shore of the lake, with its memories of Voltaire at Ferney, the Napoleons at Prangins, and Madame de Stael, at Coppet. In the mere tourist travel to such places the company has a rich lode to work, for Geneva is one of the most frequented spots in all Europe. Moreover, the mountains around the city offer excellent opportunities for pleasure travel development, if made cheaper, as exemplified by the rack rail up Mont Saleve, from whose terminal chalet, at a height of some 4000 ft. above sea level, a magnificent view is obtained, not only of Mont Blanc and the Dent du Midi, but the valleys of the Arve and the Rhone, the shores of Lake Leman and the distant crests of the Jura Alps. All this region is practically covered by the present and prospective system of the Compagnie Genevoise, and it may be doubted whether there is a better territory to be found for a system wisely and liberally administered.

There are other points of interest in the construction and operation of the road that might well be touched upon, but these must await the completion as a whole of the work, whose first stages were brought to a close in the past month of July. The executive of the system consists of S. D. Field, ingenieur directeur, and A. Kundig, chief of staff, to both of whom we are under deep obligations for courtesies extended. With them are associated F. Landolt, assistant to the chief of staff, and L. Delphin, H. Weber, J. R. Selfridge and E. Laval. It will also interest many of his former friends in America to know that young Robert McCulloch, of St. Louis, has also been associated with Mr. Field in work centering at Geneva, work of which, however, this is not yet the time or place to speak.

Filling Gravel Cars

The accompanying engraving shows an ingenious method of loading gravel at the pits, employed on the Indianapolis & Greenfield Railway, now building. The method was suggested by Mr. McMath, civil engineer of the road, with the result that the cost of loading the gravel car was only about one-quarter of that when the car was loaded with shovels. As will be noted, the means em-

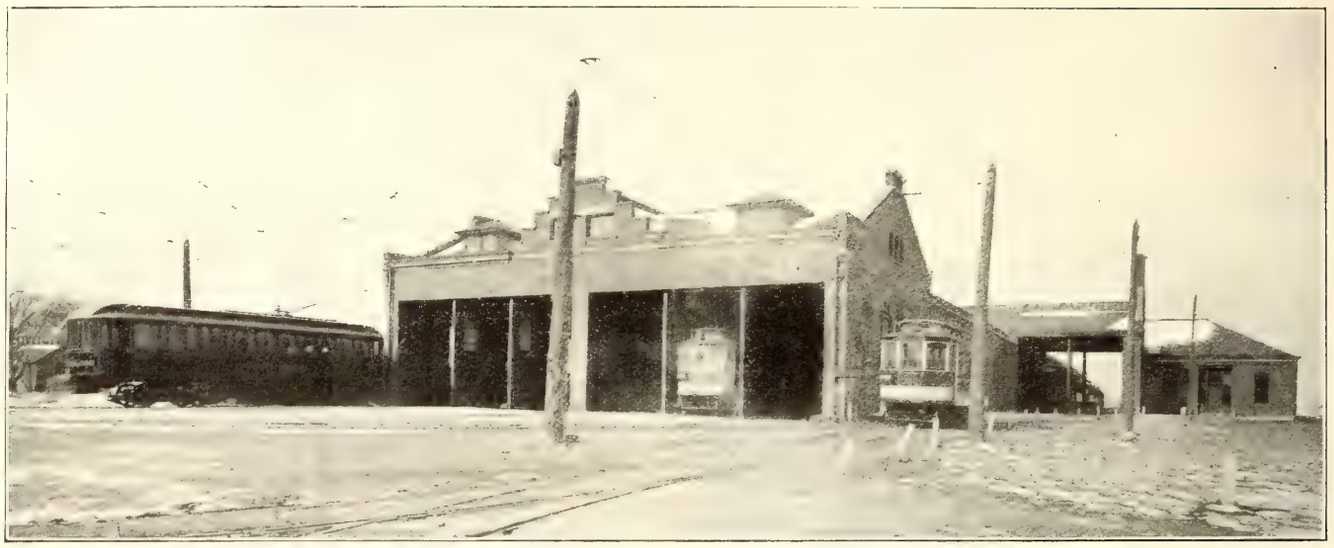
FILLING GRAVEL CARS

ployed are a temporary bridge, which can be readily removed and which is placed over temporary trucks. The road scrapers bring up the gravel and drop it through a hole in the bridge. Each team handles about 50 cu. yds. per day. The scheme, while not new, is an excellent one, but is doubtless unknown to many.

The Street Railway Journal is indebted to the consulting engineers of the Indianapolis & Greenfield Railway Company, E. P. Roberts & Company, of Cleveland, for the photograph from which the engraving was made.

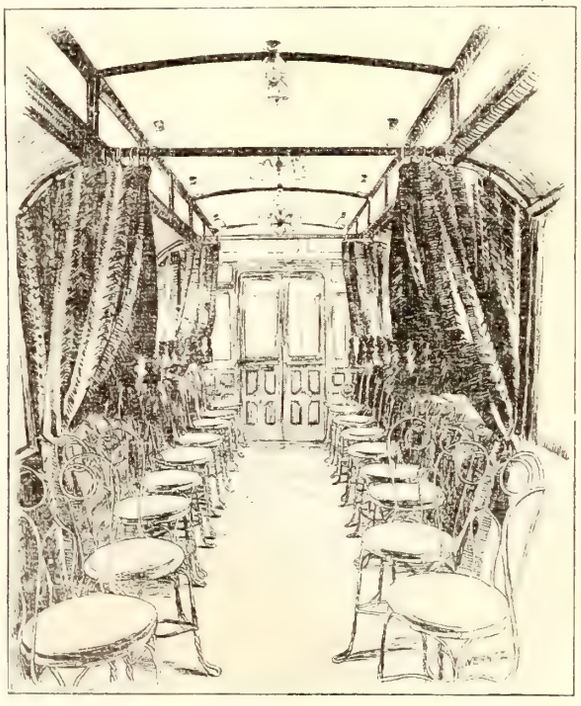
Funeral Cars on American Street Railways

Two years ago a description was published in these columns of street cars used for funeral purposes in the city of Mexico. Several cities in this country have now taken up the idea and the funeral trolley car may be seen in Chicago, Cleveland and St. Louis. The system has not as yet been adopted in any other cities in the United States, so far as is known, but the comfort and convenience which it gives will probably extend its use.



CAR HOUSE OF CLEVELAND ELECTRIC RAILWAY, SHOWING FUNERAL CAR AT LEFT

The electric funeral cars now in commission have in nearly every case been made in the railway company's own shops by changing over one of the regular cars to suit it for the service required. The cars selected have, in general, been of the eight-wheel type, and have been repainted in some sombre hue so as to combine solidity, ease of motion and elegance of appearance. Some special arrangement has had to be made for admitting the casket, but with this exception little alteration in the car body is necessary.



INTERIOR OF CHICAGO ELECTRIC TRACTION FUNERAL CAR

The car shown on the tracks at the left of the first illustration on this page was built in the summer of 1899 by the Cleveland Electric Railway Company for the joint use of that company, the Cleveland City Railway nd the interurban lines running from Cleveland to Akron, Painesville, Lorain, Oberlin, etc. It is 28 ft. long and 8 ft. wide, is painted an ebony black with simple gold trimmings and has the windows draped with green tapestry and yellow silk. The interior is divided into two compartments. The one in front, intended to receive the casket, has drop-down doors on each side and is draped throughout in heavy broadcloth. There is accommodation for four caskets besides shelves for receiving the floral offerings. Sunken rubber rollers are placed in the floor to facilitate the entrance and removal of the caskets. The rear compartment contains seating capacity for twenty-eight persons. The seats, for greater durability, cleanliness and healthfulness, are of split rattan.

Instead of a fixed partition the car used in Chicago has portieres which may be drawn or not as desired. The remains are admitted through doors in the end of the vestibules and the casket is placed on pedestals in the ordinary manner in any part of the car the mourners wish. The lines of the Chicago Electric Traction Company, which operates this car, reach the cemeteries of Oakwoods, Mt. Olivet, Mt. Hope and Greenwood, and in the spring and fall of the year it averages a trip a day.

A funeral car has lately been started in St. Louis which sets aside the middle of three compartments as the resting place of the casket. Entrance is effected by a movable panel in the side of the car which rolls upward while a trestle containing rollers on the bottom may be pulled outward to receive it from the pallbearers. It is intended that the immediate family will occupy one of the end compartments and the friends of the deceased the other. The car, which is the first of six to be installed on this road, is handsomely finished on the outside in chocolate brown and has the interior upholstered in appropriate colors with black velvet curtains and Brussels carpets.

In operation, the cars are side-tracked at the nearest convenient point during the funeral service. In Cleveland thirty-six stations have been set aside for this purpose. At the conclusion of the service the casket is carried from the church or house by the pallbearers and placed in its position. Arriving at the cemetery the casket is again taken up by the pallbearers and either carried to the grave or else placed on a hand carriage or hearse which is in attendance. While in use the funeral car has the right of way, and as it waits on a switch, both at the church and cemetery, the funeral party proceeds throughout with no delays.

Testing and Repairing Methods of the North Jersey Street Railway Company

The North Jersey Street Railway Company, which operates all of the lines in Jersey City, Newark, Paterson and in many of the neighboring towns and country, has in service over 231 miles of track and about 750 cars. The extent of its system has compelled the company to give especial attention to the care and repair of its rolling stock. Most of this work is carried on at the Plank Road repair shop of the company in Newark, although many of the car houses of the company are necessarily equipped with facilities for making slight repairs.

One interesting feature of the Plank Road repair shop is that nearly all work done is paid for on the piece-work system. This method was introduced into these shops four or five years ago and has proved most satisfactory to both men and company. The former find that they earn more than formerly, while the total cost of repairs has been reduced to the company.

The first test illustrated is that to determine short circuits in railway armatures, and employs the well-known alternating-current method, the chief novelty lying in the fact that the alternating field is portable and is taken to the armature, instead of having the apparatus stationary and

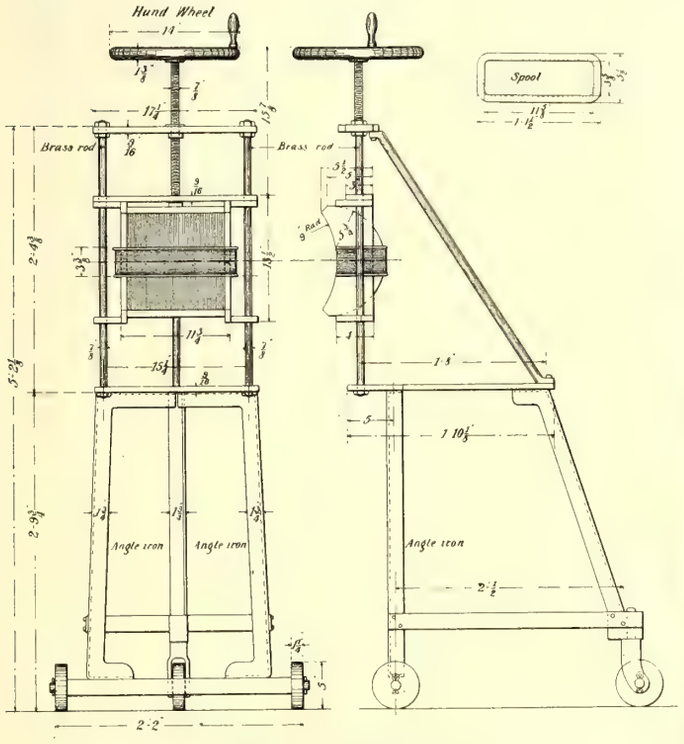


FIG. 1.—ALTERNATING CURRENT COIL FOR TESTING MOTOR ARMATURES

moving the armatures to it. The great advantage of this is that the testing rack can be moved from one lathe or winding bench to another, or wherever an armature is being repaired, and the armature coils can then be tested with a minimum amount of trouble.

The alternating field rack employed was designed by the master mechanic of the North Jersey Street Railway Company, H. H. Adams, and is so easily constructed that working drawings are given in Fig. 1, which shows a framework made of angle iron mounted on three rollers. The magnet core is made of laminated iron about 1/32 in. thick, and of the shape and size shown in Fig. 1. This device is adapted to test G. E. 800's, 1000's, 1200's and 57's, and Westinghouse No. 3's and No. 12's. The magnetizing coil is made as shown and wound with 1210 turns of No. 13 B. & S. double-covered cotton wire. The curved face of the pole piece is adjusted by a hand-wheel and screw, so that it can be shoved up against the armature without removing the latter from the winding bench.

The body of the armature completes the magnetic circuit of the alternating current magnet; the armature is then rotated by hand in this field. If any two windings are

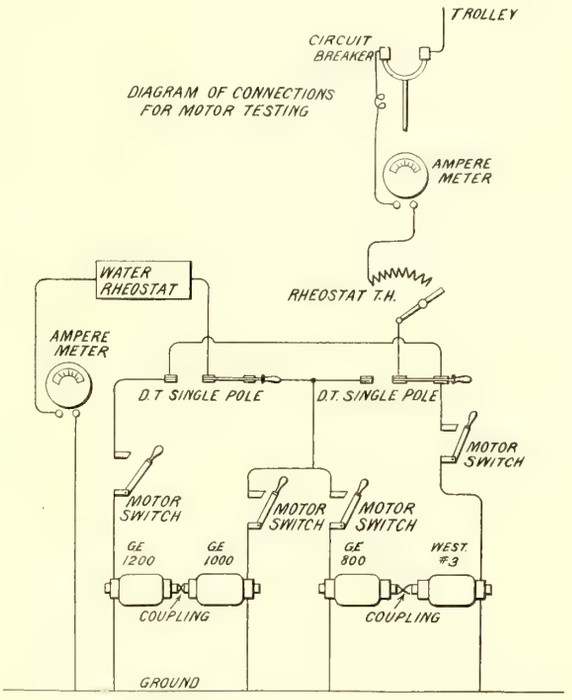


FIG. 3.—DIAGRAM OF CONNECTIONS FOR TESTING TWO ARMATURES

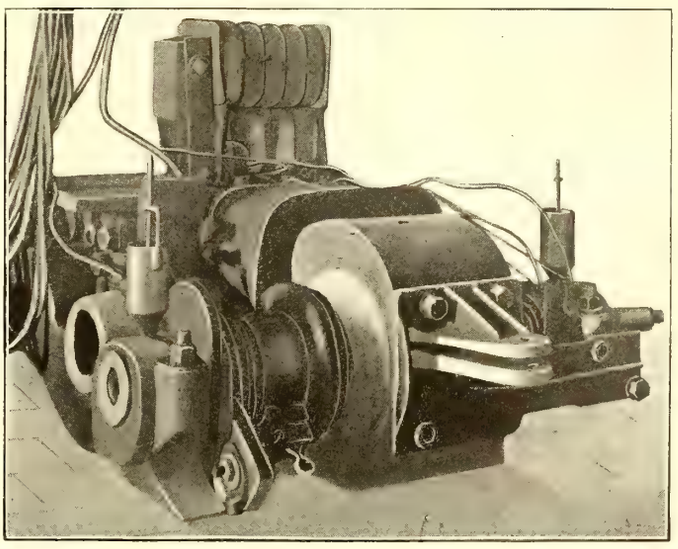


FIG. 2.—S. R. G. 30 MOTOR USED AS ROTARY CONVERTER

short-circuited and are within the influence of the varying magnetism, a local induction circuit is created which causes a vibrating magnetic flux in the teeth of the armature included in the short circuit. This is discovered by passing a thin strip of iron around the armature, which, when over a short-circuited coil, will vibrate in unison with the alternating current supplied to the magnet. This vibration is due to a local short circuit formed by the connection of two adjacent coils. The magnetism, which is induced by the local flow of current in the short-circuited coils, produces a magnetizing effect differing in its time from the magnetism of the adjacent teeth. This, as stated, causes a vibration of the iron strip when over the tooth lying between the short-circuited coils. There will be two such points in the armature at a quarter from each other

when two adjacent coils are short-circuited; but four coils are affected when the short is between commutator bars, which are connected to these two coils, and the four magnetizing areas will be found at equidistant points around the armature body.

The current for this testing device is obtained from an S. R. G. 30, Fig. 2, having two slip-rings secured to and insulated from the shaft and connected to the windings of the armature. These rings are located one-quarter of the circumference of the armature from each other in a two-pole motor. This motor is wound with a shunt field of fine wire, and has a speed of 1400 r. p. m.; this gives a good frequency to detect these crosses.

The armature room is wired for this current over the winding benches, and flexible cords with attaching sockets are located at points convenient for connecting to the testing device. When located at any winding bench an armature can be tested by this method in less than one minute.

The armature is then given a running test. There are two pairs of standard railway motor fields fixed to the floor, but turned upside down, so that it is only necessary to raise the cover of each to introduce the armature to be tested into the field, the brushes being out of the way. Four different fields are provided for the four types of motors used on the road. The armature to be tested is then directly connected with another armature in the other field of the pair already mentioned, one machine running as motor and the other as generator. The G. E. 1200 and 1000 motors are tested against each other and the G. E. 800 and Westinghouse No. 3. A chuck coupling is provided, which couples both pinions with set screws that enter between the teeth, and each pair of frames is set so that the armature shafts are aligned. Fig. 3 gives the diagram of connections for the testing of these motors. By the way the switches are thrown, the Westinghouse No. 3 is ready to run as a motor and the G. E. 800 will run as a dynamo, the water rheostat being adjusted to give the proper load for the test. The armatures are run this way for five minutes and then, by throwing over both double-throw switches, the G. E. 800 becomes the motor and the Westinghouse No. 3 the dynamo. The armatures are raised and lowered into the fields by an air hoist, which is on an overhead track, so that they can be moved easily from one end of the shops to the other.

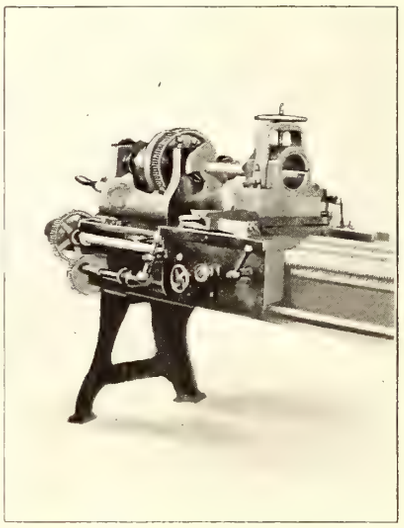


FIG. 4.—BORING ARMATURE SHELLS

FIG. 5.—CHIPPING OIL WAYS

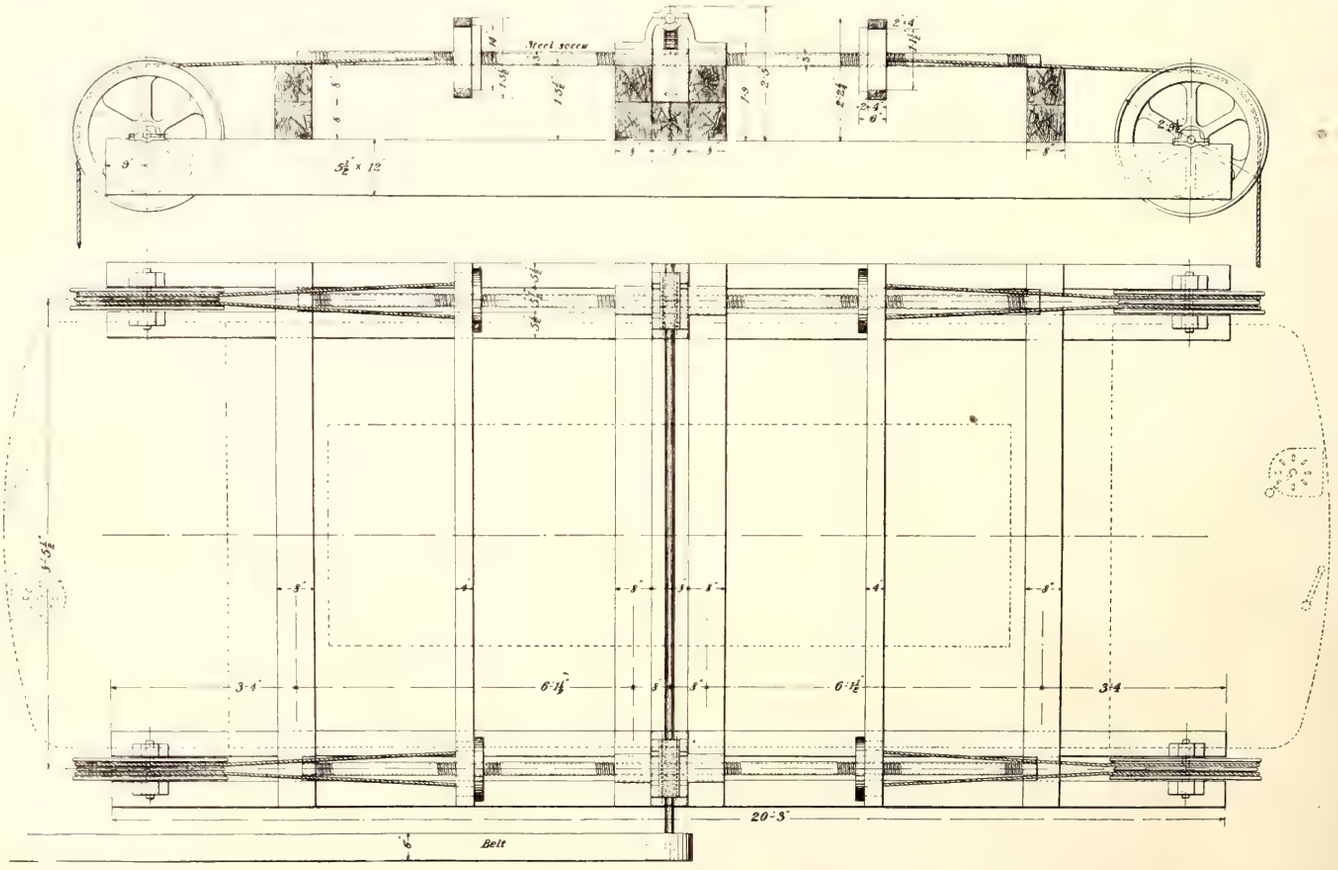
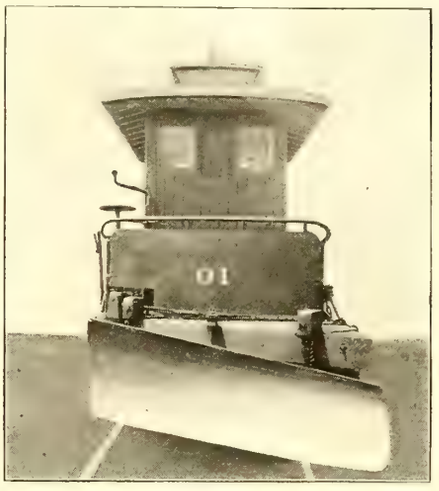


FIG. 6.—PLAN AND ELEVATION OF CAR HOIST

The method of boring out shells employed by the North Jersey Company is to mount a chuck, shown in Fig. 4, proper size chucking pieces being used for each style of shell, on the carriage of a lathe. The boring tool is fed into the shell and the babbit bored with one cut to size.

The oilways are cut by a pneumatic tool, as shown in Fig. 5. One man tends to both operations, cutting oil-ways while the boring tool is being automatically fed through the shell.



FIGS. 7 AND 8.—SNOW PLOW, NORTH JERSEY STREET RAILWAY CO.

The car-body hoist, as shown in Fig. 6, has been described in a previous issue of this paper, but the working dimensions are given, so that duplicates can be made more easily, if desired. This hoist consists of an old railway motor belted to a shaft carrying a worm, the gear of which meshes into the worm and turns a shaft provided with a right and left-hand screw thread. To the nuts which run on this thread are attached the hoisting cables, which pass over the sheaves at the four corners of the hoisting device, and drop to the floor below where the repair pits are located.

Two stringers are placed under the car body, and to these stringers the cables are attached. The motor is then started up and the car body raised out of the way of the truck. The hoist shown, Fig. 6, can raise with ease a double-truck body weighing 18,000 lbs.

The snow-plow which the North Jersey Street Railway Company employs and has designed is shown in Fig. 7 and Fig. 8. The front of the plow has a curved surface, which, instead of pushing the snow ahead of the plow, runs under the snow and rolls it over like the mould-board of an ordinary farmer's plow. The adjustment of this plow is parallel with the track and is effected by swinging the plow on two chains, both winding on a drum, to which is attached a gear, into which meshes a worm gear terminating in a staff and hand-wheel.

When in use, the plow is operated by two long radial arms secured to the car body, which resist the pressure of the snow, and the plow can be readily swung up and down by the chains. The side wings are raised and lowered by a lever hinged from a standard projecting below the platform. The width of the plowed way is regulated by a chain-guy attached to a locking lever as shown.

The track plow is a short V-shaped plow resting on the head of the rail. This clears special work and high joints by being supported on a spring, acting in the line of movement of the car. The North Jersey Street Railway Company reports such good results from the performance of this plow that the company is building a number of others.

The Milwaukee Carnival

The possibilities in the way of electrical decoration and illumination in street parades afforded by the overhead wires of a trolley road have been proved in several cities, particularly in New Orleans, and views of the floats used in the Mardi Gras processions in that city last winter were published in the STREET RAILWAY JOURNAL. The unlimited current available for lighting and power to propel the floats makes it possible to secure finer spectacular effects than would otherwise be possible. This was shown during the special carnival, held June 28 in Milwaukee, in which the trolley current was used for this purpose to a greater extent probably than ever before, and which was generally regarded as one of the most successful night pageants ever held on this continent.

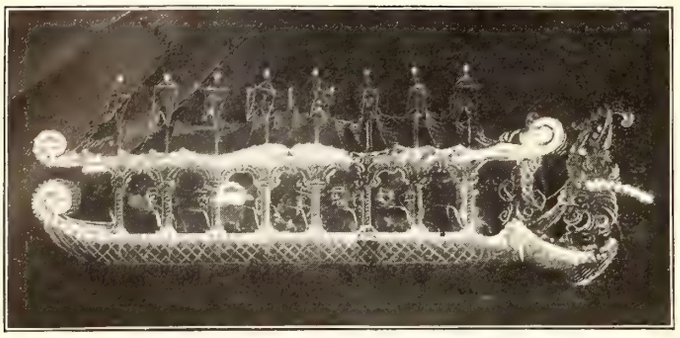
The parade consisted of twenty floats, placed on electric trucks, and lighted by 6000 lights of different colors. They consisted of a variety of subjects, presented without any aim at continuity of idea, but solely for their picturesque beauty and scope for fantastic display of form, color and effulgent light.

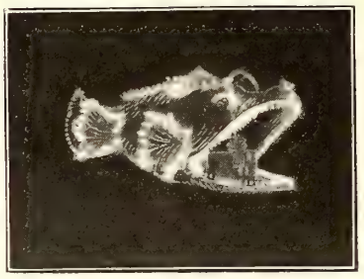
ILLUMINATED STREET, MILWAUKEE

The first float was a fac-simile of the battleship "Wisconsin," and, under the strong lights that focused on the spot, she seemed a real ship afloat on a white sea. Several musical chariots, decorated with swans' necks, whose heads extended far in advance of the charioteers, dispersed radiance and music at the same time. The float carrying

Rex was draped with foliage of tropical abundance. The king stood up in the midst of four columns, surrounded by hundreds of lights, which added an effect of royal splendor to his luxurious and majestic appearance.

A striking float was that in which the Goddess of Light stood on a sun bristling with golden rays, covered with electric lights, driving two prancing white horses. On the next float was a half godlike figure, poised on one foot, ready to fly from the banked clouds of Olympus on some world-wide errand.





VIEWS AT NIGHT OF TWO OF THE ILLUMINATED CARS

"Comus," the king of laughter, and "Jupiter," the king of gods and men, were two very attractive floats. A representation of Hades followed, which gave the public a realistic show of the unholy world, the head of Hades and his satellites having prominent positions on the car.

The largest figure in the parade, and the one that caused quite a sensation after the battleship "Wisconsin," was the whale, with one supposed to represent the prophet Jonah sitting in his wide-open jaws. This float was on a 50-ft. flat car, and was decorated with 900 lights, giving it such a glowing appearance that one could almost imagine that the sides were transparent and that by some hocus-pocus the figure in the jaws would pass down the throat and be seen after he had reached the bottom. A view of this is given.

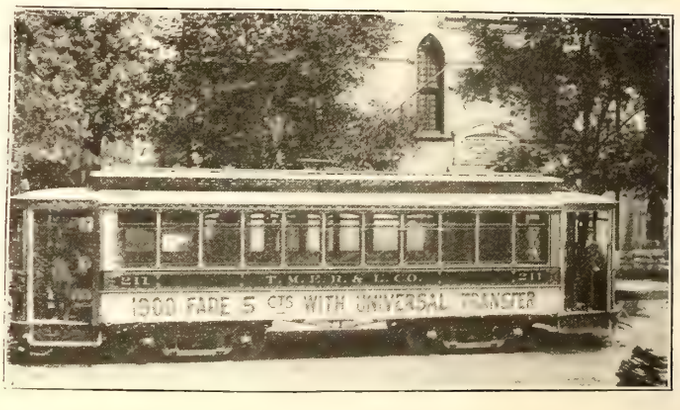
Another float was founded on the Mother Goose tale of "The Three Wise Men" of Gotham and their nautical experiences. The sea, with green and blue waves tossed mountain high, was there, and in the midst, emphasized by a corona of light that came from fifty lamps, was a bowl that carried the three immortal men.

Another float represented a dragon, with its writhing folds fitted in every joint with clusters of white lights.

Probably the most interesting of all the floats was the one that brought up the rear. It was symbolical, and represented the ideal Prince Carnival and his court. All races were represented in the motley group, not only Caucasian, Indian and Malay, but Negro, Chinese and Zulu as well. The Chinese representative was particularly admired by the crowds as the float passed, and he was pointed out derisively as a "Boxer."

The contract price for the making of the floats was $5,700, and the wiring, power and cars cost $1,800 more, making $7,500 in all.

One of the interesting features in the "funny parade" on Corso Day was the exhibit of the street railway company, which consisted of four cars, viz.: The first was an old car of the bus type, which was used on the Cream City lines in 1870. It bore a sign reading, "1870, fare 6 cents." The second was an old box-car, which had been used on the McGeogh lines in 1880. It bore a sign reading, "1880, fare 5 cents." The third was an old box-car, which had been used on Milwaukee Street Railway's lines in 1890. It bore a sign reading, "1890, fare 5 cents." The fourth was a standard double-truck, four-motor closed car, of the Milwaukee Electric Railway & Light Company, 1900. It bore a sign reading, "1900, fare 5 cents, with universal transfer." This was an object lesson, showing the great

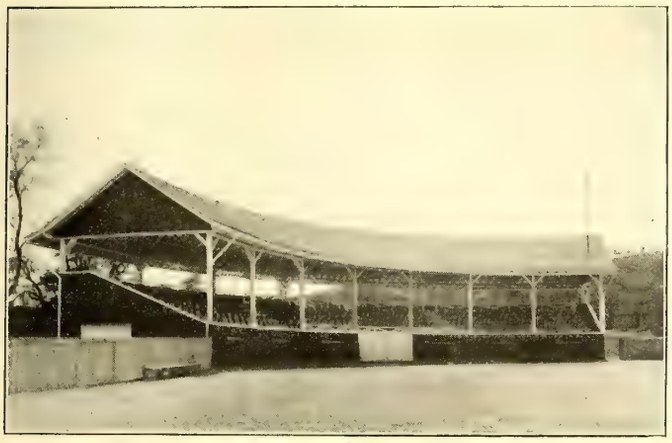


DAY EXHIBIT OF THE MILWAUKEE ELECTRIC RAILWAY AND LIGHT COMPANY

advance in street railway transportation facilities, which the thousands of spectators were not slow to appreciate.

Kennywood Park

In the monthly issue for April of the STREET RAILWAY JOURNAL a description and some views were published of the Monongahela Street Railway Company's Kennywood Park, near Pittsburgh. The views shown were of improvements made in 1899 when the park was first laid out. The success of the park during its first season was so great that the company decided to make extensive improvements this year, and the views shown in this issue are all of structures that have just been completed.



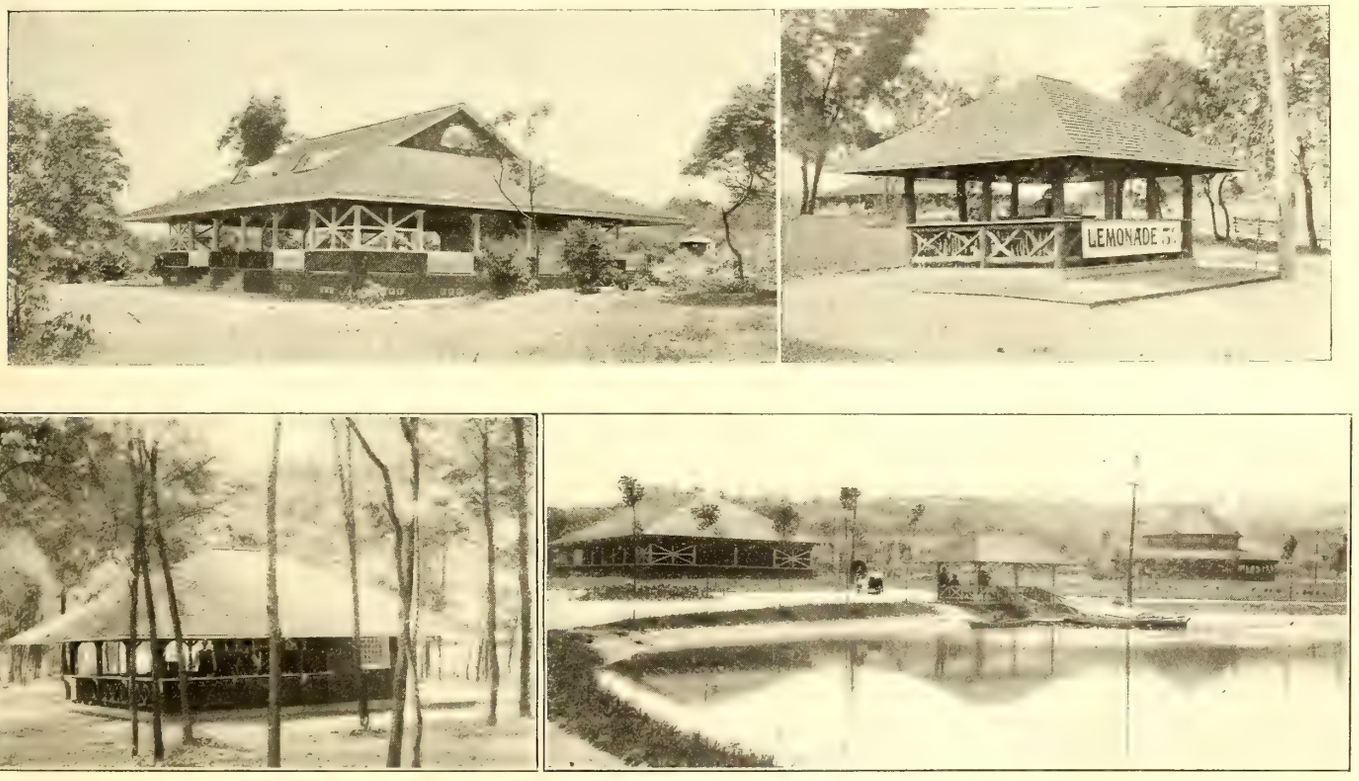
GRAND STAND

BAND SHELL

One of the principal attractions is the new band-stand, which has a stage 40 ft. wide and 40 ft. deep, with a proscenium arch 30 ft. high. There are six dressing-rooms, three on each side of the stage, for use when performances other than band concerts are given, it being the intention of the company to have minstrels, concert troupes, etc., during the present season. The stage is also provided with a plain white canvas curtain, as a protection from rain and for biograph pictures. The structure is well lighted, having over 500 incandescent lights.

Another new feature is the baseball ground, measuring 400 ft. x 400 ft. There is a grand stand having a seating capacity of 600, and two sets of "bleachers," each seating 700 persons, or a total seating capacity of 2000. The space under the grand stand is utilized by dressing-rooms for the players, a refreshment stand and storage room.

One feature of the park which was very popular last year was a private dining pavilion and kitchen, where picnic parties could have conveniences for eating their lunches, preparing hot coffee, etc. This pavilion was in such great demand that a second one was built this year, and is shown in one of the views.



TYPICAL BUILDINGS IN KENNYWOOD PARK

There have also been built several rustic refreshment stands, scattered around through the park, views of two of them being given.

The park was laid out and the construction superintended by Wilkins & Davison, civil engineers, Pittsburgh, and the improvements made this year and shown in the

TROLLEY STATION AT PARK

views were designed by and built under the supervision of Wm. Glyde Wilkins, C. E., successor to the above firm.

As will be seen from the views, the improvements are much more artistic in their design than is usual at street railway resorts, and, while they are artistic, their cost has not been great.

A Test of Incandescent Lamps for Street Railway Service

The Massachusetts Electric Companies, which own a large number of the street railway systems in eastern Massachusetts, have made unusually thorough and elaborate tests of incandescent lamps under railway conditions to determine the most desirable make for use in their cars. Twenty makes were tested, a barrel of each being bought on the open market. Ten lamps of each make were connected in two series of five each and supplied from a street-railway circuit with the usual commercial regulation. The five lamps in one series were given a life test, and whenever one burned out a lamp which had burned the same number of hours in the other series of the same make was put in its place, a new lamp being put in the second series. Each lamp in the life-test series was measured every twenty-four hours for candle power and watts. The work was carried on at the Hyde Park station and required no small amount of work, two men being constantly employed for the six weeks during which the test was continued. By night, when the street railway system was shut down, the 200 lamps under test were supplied by a special machine at constant voltage.

Great care was taken to obtain accurate standards, three standards being obtained from each of the three companies; one from each company was sent to the electrical laboratory of the Massachusetts Institute of Technology, where five more standards were prepared; secondary standards were then made from these five. The companies' specifications call for a 4-watt lamp giving an initial candle power between 15 and 17, and taking initially a power between 60 and 66 watts at 110 volts, no lamps to drop below 25 per cent of the initial candle power within 1000 hours.

Can Small Electric Railways be Operated at a Profit? I.

BY JAMES BLAKE CAHOON

The statistics given in the report of the New York Railroad Commissioners for 1899 are certainly deserving of the most careful study by the managers of small roads. When the electric railway was first introduced everybody took it for granted that under any condition in which a franchise for the operation of an electric road could be obtained, no particular thought need be taken as to whether or not it would be a paying proposition because it was assumed that it must be. This assumption was perfectly correct so far as the operation of an electric road in a large city is concerned, this class being money makers from the start, but to the surprise of nearly everyone electric railways in smaller cities as a rule are only just able to make their bond interest, or show a deficit.

There are ninety-four electric roads in operation in the State of New York; in the year 1899 forty-one of these showed an actual deficit, fourteen declared dividends ranging from 1 per cent to 12 per cent. Of those that declared dividends, four only were in the smaller cities, three being operated partly as interurban roads, and one declaring a dividend on its capital stock, although it had accounts payable largely in excess of the amount of the dividend and its surplus, the interurban part of the roads in smaller cities seeming to be the salvation of the whole.

We are then confronted with the condition, practically, that roads in other than the first and second-class cities, where electrically operated, are not at the present time a paying investment. In searching for a reason for this it is necessary to go back over the history of the equipment of electrical roads in the past ten years, and study cost of installation, methods of management and rates of fare, and see whether one or all of these were instrumental in bringing about the present condition. Naturally, in the beginning of the industry, equipments were crude and expensive. Many roads, in changing over from horses to electricity, placed the motor equipments on their old cars, and did nothing to their tracks other than to bond them and build an overhead line. First the cars went to pieces, then the tracks, and the equipments struggled along in varying conditions, all having finally to be replaced.

When the conversion was made the money for it was obtained, as a rule, by issuing bonds; then, when the tracks had to be rebuilt and new cars and new equipments ordered, new bonds had to be issued, so that for the ultimate equipment of the road, practically a double issue of bonds was made, the first issue being for experience so far as actual benefit was concerned. The result is that the roads which were converted from horse to electric are now confronted with interest charges on a double issue of bonds, which render the task of making the roads a paying investment very difficult, and one by one these roads have given up and gone through the process of reorganization and rehabilitation in an effort to place themselves on a paying basis.

The *Century Magazine* for June, 1900, contains an article in "Topics of the Time," headed "Public Peril in City Franchises," in which it states that "those who are watching current events must be aware of a remarkable activity on the part of those corporations engaged in the performance of public services in the cities in the direction of securing extension or confirmation of the privileges they are enjoying, and that franchises have been granted and renewed for almost no consideration," and further on it remarks that "these franchises are in almost all cases

enormously overcapitalized;" that "what they wish to do is to pay interest on two or three times as much capital as they have actually invested."

It is true that a street railway to-day could be built at much less expense, and with much less burden of bonded indebtedness than roads are at present carrying, but the bonded indebtedness of existing roads is an honest debt, contracted with the idea of, in the first place, giving the public adequate service, and secondly, meeting the constantly increasing requirements of the people for better service. Undoubtedly, the original promoters went into the project with the idea of making money for themselves; they built the road, placed the bonds and took as compensation stock which paid well for a sufficient time to enable them to unload largely on the local people, but as years went on the dividends became less and less, the stock depreciated in value to nothing almost, and the men who are holding these stocks to-day are men who put their money into them in good faith and are endeavoring under almost hopeless conditions to obtain a fair return for their investment.

If their franchise expires and they do not obtain another or a renewal of the old, the money they have invested is hopelessly lost. The *Century* speaks of overcapitalization, injecting water into the stock, etc., and thinks that franchises should be paid for, and it is conceded that they should be where the franchise is of value, but, so far as railways are concerned, such franchises are of value only in the large cities, and in order that justice be done, distinction must be made between street railways of small cities and those of larger cities. What they may assert with perfect truth as regards railways in large cities would be anything but true, and a rank injustice to railways in small cities.

In general, the roads of which we speak were laid out somewhat crudely, but they may be roughly divided into four classes: First, the city having its business concentrated largely on one main thoroughfare, covering a territory about one-half mile in length; surrounding and reaching out from this lie the residence districts, and the road found in this class of city usually consists of three to five short branches running out into the residence districts and centering in the business district. In the more pretentious cities efforts have been made to attract travel to the road by the establishment of a summer theater and park on an extension of one of these radial arms, and this may be classed as the second division. The third division is where the town is divided by a river, and has the main business thoroughfare along the river, the town extending in a general way along both banks without running very far back at any one point. In this class of town the railway usually zigzags from one end of the town to the other, and if the settlement be about equal on both banks of the river, effort is made to reach the people on one side by means of branches or a loop system shooting off from the main line. The fourth class is formed from a combination of the first and third classes, with an interurban branch extending to a small town from 5 miles to 15 miles distant. A distinct characteristic that may be noted of all this class of roads that have been in operation for some years is that their superintendents and managers, who have striven hard to make the roads pay in the face of an utter indifference on the part of the public toward helping them, have become imbued with the idea that, even though they practise the most rigid economy, they can just barely scrape together enough to make both ends meet.

They have become, as it were, hardened to the work and more or less blind to existing conditions, with the result that the property is gradually running down hill without their knowing it, and people become more and more indifferent to riding on the cars. Another characteristic is of the people of the towns themselves—a great majority is made up of those whose income is not great and to whom a nickel seems large. In the large cities, where the distances are great, the people naturally have to ride to and from their work; in the smaller towns this is not so. Usually in fifteen minutes the mechanic can walk from his house to his place of work, and the same is true of the great majority of people. The result is that rather than spend 10 cents a day to ride to his work in the morning and back at night, he will start ten or fifteen minutes earlier and walk the distance, hence the proportion of passengers riding in the smaller cities is much smaller than in the large cities.

For instance, if we were to compare the city of New York and one of the small inland cities of the State, we would find the number of passengers carried per car-mile to be three to one in favor of the large city, while, by rigid economy, the operating cost per car-mile on the smaller road is less even than on that of the big system; yet an operating expense of less than 10 cents a mile on the small road may mean that their operating expenses are 90 per cent of their gross receipts, while on the large road the same cost of operation per car-mile would probably mean not over 45 per cent of the operating expenses to gross receipts. The small road would not pay; the large road would pay the interest on its bonded indebtedness and a handsome return on a proportionate amount of stock based on water.

In the large cities the people must and will ride; in the small cities the people will not ride unless they either have to for some particular reason, or are willing to give up their nickel for considerably more than its value in pleasure, and the problem presented to the street railway manager is how to get this class of people to ride so that he can make his road pay. In general, the answer is that, taking into consideration all local conditions, he must contrive in some way to convince the people of the small town that he is not only giving them the worth of their nickel, but several times more than that, either in the way of very quick transit to and from their business, or in the way of amusements and pleasure of much more than the value of the nickel.

The nickel has become in a measure accepted as the general rate of fare for street railways, but local conditions may be such that, in order to get people to ride, it may prove the salvation of the road to lower the price; as, for instance, take in the first class of towns mentioned, where lines branch from a common center and no one of the branches is more than about a mile long. In a town like this the great majority of people would walk rather than pay 5 cents to ride a short distance, and a road charging 5-cent fares would have uphill work, but it might be so arranged that very cheap rates of fare could be given—say forty tickets for $1, with the understanding that those tickets are good for a ride on any one of the branches to or from the center of the town. If a passenger wants to go beyond the center of the town, then he pays for another ticket, and in case there was a park situated at one end of one of the branches, coupon tickets could be provided so that everybody riding to the park would have to pay 5 cents each way. Where passengers got on and did not have tickets, the cash rate of fare could be made 3 cents.

Suppose, under these conditions, the road just barely paid expenses with 5-cent fares, and by the reduction of these you could get three to four times as many people to ride, it will be seen that the road would naturally become

a paying proposition. Another method applicable to roads that zigzag through a town is the introduction of low rates of fare similar to the above outline, that is, forty tickets for $1, to be used during working hours. This has often proved the salvation of a road of that class.

On the roads of the fourth class, having an interurban connection, where the ordinary fare is 10 or 15 cents between the towns, make a commutation ticket, good for people going between the towns for business or work daily, on the basis of 60 per cent of the regular rate of fare, and on pleasant days give excursion rates in the afternoon and evening in the summer time, or when there is a skating carnival or anything of that nature gotten up in the winter time, at half rates. Then, instead of the cars running nearly empty during these hours, they will be well patronized and the receipts of the road materially increased without adding much to the operating expenses.

Naturally following this comes consideration of what it is necessary to have in the way of car equipments. It is absolutely necessary that these small roads be operated with a minimum amount of car equipment, and the first thing to be settled is the type of car which is best suited to work under all conditions in both winter and summer, as this class of roads cannot afford to maintain a double equipment of cars. Meeting this requirement as well as anything at the present time is a car of about 26 ft. length of car body, with double trucks, center aisle and cross seats of cane bottoms, vestibule ends, window sills cut down low, and the windows preferably double sash, so that they can be dropped down to make the car to all intents and purposes an open car in pleasant weather. Several combination cars have been exhibited—some with panels which can be taken out, and some with panels which slide up on the roof. These are now on trial and may prove a satisfactory solution of the problem, but their expense and construction are against their being adopted by small roads.

If we take, for instance, a road operating ten cars gen erally, and it has a park on one of its lines, in the summer time it may become necessary to operate twenty-five or thirty cars to handle the crowds during rush hours or on circus days or Fourth of July. A ten-car road should have as its equipment, where it has a park, fifteen motor cars of the type mentioned above, and as many trail cars. Where no park is in existence and it is only necessary to operate short lines, trail cars are not necessary, but the same number of motor cars should be had, for reasons which will appear later under method of inspection. Interurban roads would require two-thirds as many trail cars as motor cars.

The motor equipment where there are any grades should preferably consist of two 50-hp motors; 25-hp motor equipments, although they cost less at the beginning, are more expensive in the end, on account of costing more to maintain, and not being capable of satisfactorily handling two or three trail cars, heavily loaded, as may be often necessary. Speed is especially desirable in small towns, and usually these cities do not limit the speed as closely as in the larger towns, and, as a rule, cars should be operated at as high a rate of speed as is consistent with safety, slowing down on the busy thoroughfares, and the point of rapid transit should be strongly emphasized to induce people to ride. The heavy equipments mentioned serve admirably to the furtherance of this purpose, having sufficient reserve power to maintain time schedules with two trailers added.

Much has been written and more said, pro and con, in regard to the rate of speed at which to operate cars than on any other subject. I believe every writer who has given the matter serious consideration has tried to solve the problem by deducing rules governing the operation of electric roads in general. As a matter of fact, every road has got to be treated in a more or less different way, for roads are very much like human beings—they may have a general type of sickness and the same remedy may be applicable to all cases, but each requires supplementing with other remedies peculiar to the patient considered. Just so with regard to speed—one road may find it decidedly advantageous to operate at a very high rate of speed, while another, on account of certain local conditions, may find it more profitable to operate at a moderate rate of speed.

I remember one case in particular where a road zigzagged all over the town, and crossed and recrossed the steam railroad track several times in the course of its route. The cars were operated on fifteen-minute headway, but given a very slow time card. In talking the matter over with the manager, seeking the reason for this, I found that while he wanted, and his patrons almost imperatively demanded a high rate of speed, it was practically impossible for him to give it, the town being situated on the main line of one of the large steam railroads with an enormous freight traffic; long freight trains were running through the town continuously, so that the same motor car would be stopped at the first crossing to wait from two to seven minutes for a freight train to pass, and then get up to the second crossing and strike the same train again. If he operated at a high rate of speed the cars would simply get up there and wait for that train to pass again. The only thing he could do under the circumstances was what he did—that was, to give between these crossings a slow enough time card so that the car, if blockaded at the first crossing, would arrive at the second crossing about as the freight train was getting by, and hence would not be detained there any length of time.

If he had operated his cars at the rate of 20 miles an hour he could not have made the second crossing ahead of the freight train which blocked him on the first crossing. The final solution of the problem presented was to take up the tracks between the first and second crossings and relay them so that they paralleled the steam road, cutting out the first and second crossings and effecting a crossing so as to reach the most populous part of the town at a distance of something like a mile further away. The track then doubled back on the opposite side of the steam road for a distance of about one-half mile to reach certain manufacturing establishments located at that point. By doing this they were enabled to increase the speed of the cars and largely increase their traffic by taking the operatives night and morning to and from the manufacturing establishments in question, and the people all along the line patronized it much more extensively than they did, simply because of the increased speed.

One peculiarity of the operation of cars in small towns is the fact that each individual patron thinks the road is run especially for his benefit, and consequently, that the cars can stop anywhere, and ladies think that they can signal the car and then go back and put on their things, and the car ought to wait while they do it. People who reside along the line think that the conductor ought to know where they get off without saying anything to him; consequently, they visit with their neighbors on the car and chat along; by and by the car goes by where they live two or three blocks, and they look up and find that they have been carried by and are highly indignant at the conductor. It takes a great deal of education to remove this impression. I recall an instance in my own experience where, having resolved on putting into effect a higher rate

of speed for the cars, I had large signs made, which were attached to poles at the corners of certain streets on this particular line, two blocks apart. On these signs were painted the words, "Car stops here," and I gave instructions that the cars were not, under any circumstances, to stop except at those points.

The result was that I was kept busy for a week or more explaining to indignant citizens that in order to serve the interests of all to the best advantage it was necessary to adopt a higher rate of speed, and therefore, in order to make the schedule time, cars could not stop except at the points indicated. Finally, after several weeks' trial, the people got used to the change and found it so satisfactory that all signs of discontent passed away and the traffic on the road increased considerably, due, as most people said, to the fact that they did not have to stop at everybody's door, and consequently could get down town in much less time. At cross streets where there were numerous carriages, truck teams, bicycles, etc., passing, I put up danger signals and signs on which were painted, "Cars must stop here," and required all cars to come to a stop at these points whether they had passengers for them or not, in this way materially reducing the liability to accident incidental to a high rate of speed.

Another precaution taken was to absolutely prohibit anyone riding on the front platform with the motorman. It seems almost unnecessary to mention this, but in numerous towns that I have visited I have found passengers riding on the front platform, and that at all times, and it is absolutely certain that cars cannot be operated at a high rate of speed with safety unless the motorman has nothing to distract his attention from the work in hand. When this rule is first put into effect there is a universal protest against it on the part of patrons of the road, but it should be rigidly adhered to, and they soon get accustomed to and do not mind it. Several managers with whom I talked in regard to putting this rule into effect raised the point that, in order to encourage traffic, they must give citizens the entire run of the car and practically let them do as they please. Where this latter rule is followed, however, discipline is lax, accidents are of frequent occurrence, and the road presents a slipshod appearance, which is not inviting, to say the least. If people are made to understand that it is necessary for them to observe certain rules in order to co-operate with the company to secure safety in operation there will be little or no difficulty in the enforcement of the few requirements necessary to insure the greatest freedom from accident.

Insurance companies offer to insure street railways in the smaller towns against accidents for from 2 per cent to 2½ per cent of the gross income, and are apparently not overprosperous at that rate. It seems to me that this is a direct reflection on the operation of this class of roads, for, following out the few simple rules laid down above, during five years that I operated a street railway in a town of 40,000 inhabitants, the amount paid for injuries and damages in any one year never reached one-half of 1 per cent of the gross receipts, and usually did not exceed one-quarter of 1 per cent, and yet we were operating the road, except on one crowded thoroughfare, where we slowed to 6 miles an hour, at an average speed of about 12 miles an hour, including stops, making the actual running speed of cars about 50 per cent higher. Probably many railroad men when they see this will immediately want to know what fender we used to make our accident list so small, and as a reply to them I will say that we used no fender at all, except that best of all, a competent and vigilant motorman, who was carefully selected and trained for his duties before being given a car, and careful and systematic attention to the brake mechanism.

Another peculiarity of operating cars in small cities is the irregularity of about one-half the traffic. There is a certain constant load at what may be called the working hours, in the morning, at night and at noon, and this is supplemented or decreased according to the time of the year, condition of the weather, etc. From about 10 o'clock in the morning until 11:30 cars coming from the residence districts to the business center of the town often have very light loads and occasionally, as the boys say, "turn a goose egg;" that is, do not register a single passenger. We plotted a curve of traffic at different seasons of the year, taking a week's record at each time, and subsequently kept a check on this curve, and, as we all know that the best economy is obtained by getting the low points and peaks out of this curve, the problem presented is how to get people to ride during these idle hours was an interesting one.

The stores would have mark-down sales, which would bring the ladies out in force, and, as they opened at 8 o'clock in the morning on these days, the ladies would supplement the ordinary travel during the heavy-load hours, and often tax the regular cars to their utmost. It finally occurred to me that if I would take the merchants into my confidence it might solve this difficulty very nicely, so, as the opportunity presented without making any marked effort in the matter, it was suggested to the different merchants that if they would arrange to have their sales open at 10 o'clock, instead of 8, when they opened their stores, they would help us and give the ladies a chance to get their housework out of the way before coming down town, and they would therefore feel free to stay longer and shop more than they would if they had to hurry home and get their housework out of the way before dinner.

They readily fell in with the suggestion, and I think it was profitable to them, as it certainly was to us. Of course, the manager of a road in a large city would not be obliged, nor would he have the time to study these finer problems, but in the smaller cities it behooves the manager of the street railway to thoroughly familiarize himself with every detail that will affect the traffic of his road and cultivate the friendship and good-will of the storekeepers, and by keeping in close touch and working together the irregularity of the traffic can often be eliminated.

(To be Continued.)

Plans for a Chicago Subway

President Roach, of the Union Traction Company, presented the Street Railway Commission with detail plans for a subway under the down-town streets of the city, at its meeting July 25. Mr. Roach had previously outlined his plans to the Commission, and at their invitation presented his plans in detail on the date mentioned. President Roach has intimated that if the subway is built by the Union Traction Company, the franchise will have to be perpetual. He positively refused to consider a twenty years' proposition, and stated that if the subway is constructed it must be on terms that will settle the problem for all time.

President D. G. Hamilton, of the Chicago City Railway, was present, and listened with deep interest to the proposition advanced and criticisms made.

The Metropolitan Street Railway Company, of Kansas City, is now operating five cars painted a Pullman brown, both outside and inside. The cars are being run as an experiment to test the wearing qualities of the new color, and with a view to its adoption as a standard with the company. Its cars are now painted a light color, but this requires much care and constant retouching.

CORRESPONDENCE

The Characteristics of a Successful Street Railway Manager

Metropolitan Street Railway Company
New York, July 2, 1900.

Editors Street Railway Journal:

I have read with much interest the editorial in your June issue describing the "Characteristics of the Successful Street Railway Manager," and heartily indorse all that you say therein as being strictly true. If the imaginary and rare man you have depicted is possessed of good health—one very important element in success—there is nothing left to be desired. As I review the characteristics you have named, they are:

First—Honesty and loyalty.
Second—Sincere regard for employees.
Third—Force and decision of character.
Fourth—Organizing ability.
Fifth—Diplomacy in dealing with the public.
Sixth—"Horse sense" concerning engineering problems.
Seventh—Determination never to undertake an impossible nor to abandon an achievable thing.

These seven virtues combined in one person would constitute, from my point of view, "the very figure of a man," and yet I can conceive conditions under which he might not be a success in managing a property. We managers are now and then apt to lose sight of the influence of our surroundings and associations, and vaingloriously appropriate all the credit for successes which are the result of co-operation of various kinds; for, powerful as the modern manager is, there are limits set to his authority by the superior power of ownership. Hence, I can conceive such a man as you have described making a failure with a property, the ownership of which was in the hands of selfish, narrow-purposed men, uninfluenced by those broad public considerations which are so interwoven with the affairs of public service corporations.

It may be answered that to allow himself to become associated with such a class of owners would in the first instance argue that the manager lacked the virtues of the seventh class. The real character of owners, however, is not a matter of record. One does not demand a certificate of character from an employer, indorsed by the last servant, and there is no way a manager can ascertain what the owners are like until he has tried them, off and on, in fair weather and foul.

And so the thought has come to me, in thinking the thing over, that, after all, the manager is unlike the poet, for he is made, not born. Put the man, born with all the characteristics named, into bad company, and the chances are nine to ten you will spoil him. I have no sympathy with those impossible men who have never worked out their potentials because they have never been in the proper kind of company, but, with my conviction that there are more good and able men in the world than is generally supposed, I can only account for the small evidence they give of their existence by the probability that they are in bad company.

One might go even a step further with this idea and arrive at the conclusion that a pretty fair kind of a manager, without some of the seven virtues, could be made by the loyal and liberal co-operation of an enlightened and public-spirited ownership, but to pursue the thing too far would be looking at the manager through reversed binoculars, and, being of the class myself, I do not care to inaugurate a habit of this kind.

H. H. Vreeland.

June 30, 1900.

Editors Street Railway Journal:

I am much interested in an editorial appearing in the Street Railway Journal of June 2, this year, entitled "Characteristics of the Successful Street Railway Manager." I have read the same carefully, and certainly indorse fully all that portion directly referring to what the manager should be, but is it true that there is a great scarcity of competent managers? My impression has been the reverse. It appeared to me that the recent consolidations all over the country had thrown out many managers, some of whom, at any rate, it would seem must be men of ability. I placed an advertisement in the Street Railway Journal in two issues which brought only two replies, and these from small properties wanting "a capable manager for $75 or $80 per month." This should not be considered as a reflection on the value of the paper as an advertising medium, but shows that there is a surplus of men capable of handling large properties. These offers were, of course, courteously declined; a man of any ability can double that loafing in this country.

I will not tire you with a long recital, but I believe that I can fill every requirement outlined in the editorial referred to, and believe that I can make it so appear to any syndicate requiring such a manager if I can get into communication with them. If you know of any such I should be glad to be furnished with their address. I am a man who studies his business and is always prepared for the emergency before it arrives, and I have been successful in the extreme in maintaining amicable relations with city officials, the public and the press without giving away all the company's property, and have been successful in the handling of employees, and yet retaining their good will. This latter was exemplified here when giving up my position in the reorganization, the employees made me a present and still seem to try if possible to show me greater deference than when I held their jobs in my hand. This was a surprise to me, as I had always been very strict, and would never tolerate inattention to duty, yet careful that employees should all be treated justly and no favorites. I have also had to face the "stockholder's son" and kindred propositions, too, but I would simply tell them that all I could do was to give them a place—*they must hold it*—and turn them over to their superintendent. Prompt decision is one of my strong points. I have always made it a point to have my business so well in hand that I can say instantly what I will do—I have a strong contempt for a vacillating business man. I combine the engineer with the business man—know thoroughly how things should be done and how to pick the cheapest and the best way, yet understanding that the ever-present problem in railway management is not simply what can we do, but rather *what can we do without.*

John Smith.

A Note of Warning on Polyphase Transmission

Boston, Mass., July 16, 1900.

Editors Street Railway Journal:

I have noted with the greatest interest the long array of electric railways using rotary converters, as published in the Street Railway Journal for June. So long a list augurs well for the practical advantages of polyphase power transmission for railway purposes; and a little inspection brings into prominence the fact that these roads represent almost every possible case of transmission to rotaries. Some of them merely utilize transmitted power in a central station; others are long roads, winding from city to city, and fed from sub-stations deriving their power from a long transmission line, linking them with a main

generating station; and still others represent various phases of distribution, from a huge urban station to its auxiliaries. All these applications of the general methods of power transmission may be of great value in electric traction, but as a consistent advocate of polyphase apparatus and methods, and an earnest student of the problems arising from the enormous growth of electric traction, I feel it my duty to sound a note of warning—a warning directed, not against power transmission to rotaries, but against making a fetish of any method, however useful intrinsically.

I regard it as certain that many of the roads enumerated in your imposing array are transmitting power wisely and economically, but there is, on the other hand, little doubt that some of them are wasting their substance fruitlessly in zealous endeavors to follow the latest fashion. It is no more reasonable for all roads to use the same engineering methods than it would be for all their superintendents to wear white bell-crowned beaver hats as a badge of office.

Now, in point of solemn fact, it is sound engineering to transmit power only when such transmission has a logical, economic reason for existence. Every such plant necessarily wastes power in the transformations necessary to its operation, and must show due cause therefor in an ultimate saving or stand condemned.

In the ordinary use of rotary converters there are to be encountered the aggregated losses in the transformers, the lines and the rotaries themselves. In these are consumed under ordinary conditions of load from 20 per cent to 25 per cent of the energy input. This loss is irretrievable, and must in some way be compensated if an economic result is to be attained. For every 75 kw to 80 kw delivered by the rotaries 100 kw must be delivered at the generators, and in addition one must buy and install transformers and rotaries nearly equaling in output the main generators, besides installing the transmission line itself. That is, to deliver 75 kw or 80 kw to the lines one must have a rotary converter of that capacity, transformers for the same, and a 100-kw polyphase generator at the other end of the line. If one can drive that generator by cheap water power the outlook is generally comforting, but when it is deliberately proposed to drive it by steam power there must be a truly prodigious saving somewhere to offset the necessary and unavoidable losses. If one is dealing with 10,000 kw, instead of 100, the need of showing a saving is by so much the more imperative. Now, it is undoubtedly true that power can be generated much more cheaply on a large scale than on a small one, and in this fact lies the key to the situation; but unless the saving is in the neighborhood of 25 per cent or 30 per cent there is a hard outlook for economy in using rotaries, and the bigger the system the more difficult is it to show such a saving. In considering the application of transmission methods on a large scale a good preliminary step is to consider the effect on the economy of a great station of merely putting up a heavy partition wall, dividing the station into two equal and symmetrical parts, and forbidding employees to cross from one to the other upon any pretext without an hour's notice of their intention. Unless the total cost of the year's output would be increased at least 25 per cent by this simple change sufficient reason for the use of rotaries, rather than distributed stations, will have to be looked for with a search warrant. In rare instances some one site for a station may have great natural advantages and lead to economic results that could not otherwise be approached, but it is not safe to jump at such a conclusion or to accept it without heavy preponderance of evidence, particularly in view of the fact that even sub-stations require costly space and considerable attendance. If in the course of events it becomes generally feasible to use alternating motors for traction purposes, the case will resolve itself into a simple transmission problem, and a favorable solution will not be difficult to reach. At present, as I have endeavored to point out, the application of transmission methods to traction work involves economic losses so considerable and serious that one will do well to stop and think twice before incurring them. In very many cases they can be more than offset by gains due to the very processes that involve them, but it is worth while to call forcible attention to the fact that such is by no means a foregone conclusion. Louis Bell.

Street Railway Statistics and Municipal Ownership

Cleveland, Ohio, July 17, 1900.

Editors Street Railway Journal:

I am anxious to get statistics for the last five years on the mileage, number of cars and capitalization of the street railways of the United States, and would also like to know in which issues of the Street Railway Journal you have published articles on municipal ownership of street railways. F. S. Vernon.

[Answer.]

Statements of cars, mileage and capitalization of American street railways for the past five years can be found in the Street Railway Journal for July, 1895; August, 1896; October, 1897; February, 1899, and June, 1900.

We have, of course, published a great many articles on the subject of municipal ownership and operation of street railways, and almost every number of the Street Railway Journal has contained something on this subject, but possibly the most important articles are in the following list.—[Eds.]

May, 1897. Editorial on "Street Railways vs. Municipalities."

September, 1897. "Municipal and Private Ownership and Operation of Street Railways. A Study of Results and Possibilities," by Edward E. Higgins. This is, so far as we know, the most extended defense of private ownership which has been made in this country.

September, 1897. Editorial entitled "Municipal vs. Private Management of Street Railways."

November, 1897. Paper by P. F. Sullivan on "Municipal Ownership and Operation of Street Railways."

December, 1897. Editorial on "The Case for Municipal Operation of Street Railways."

August, 1898. "An Act Relative to Street Railways," passed by the Massachusetts State Legislature.

May, 1899. Editorial discussion on municipal ownership.

May, 1899. "Municipal Ownership in Detroit."

August, 1899. Editorial and article on "Proposed Solution of Municipal Franchise Problem," from Allen Ripley Foote's work upon "Municipal Public Service Industries."

April, 1900. "Some Differences Between American and British City Transportation Methods," by Edward E. Higgins. This is a complete refutation of the prevailing popular belief that British methods of dealing with street railway companies means greater revenue to the public treasury or improvements in any way as compared with "the American system."

On July 19 the Mayor of Montgomery, Ala., vetoed the ordinance to prohibit the operation of street cars in the city of Montgomery without conductors. The Council passed the ordinance July 9, with an amendment excepting roads that did not operate six cars. The Mayor vetoed the ordinance on the ground that it was illegal and inoperative, in that it excepted roads not operating six cars. The Mayor thinks that if the safety and convenience of the public demands conductors on some cars they are necessary on all, and he is opposed to any discrimination between the railroads operating cars in this city.

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Papers and correspondence on all subjects of practical interest to our readers are cordially invited. Our columns are always open for the discussion of problems of operation, construction, engineering, accounting, finance and invention.

Special effort will be made to answer promptly, and without charge, any reasonable request for information which may be received from our readers and advertisers, answers being given through the columns of the JOURNAL *when of general interest, otherwise by letter.*

Street railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our news columns.

All matters intended for publication in the current issues must be received at our office not later than Wednesday of each week.

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It may be news to some of our readers to know that funeral cars are now running regularly on street railway lines in Chicago, Cleveland and St. Louis. Elsewhere in this issue we publish a description of some cars now in commission, and of their mode of operation. As yet the system may be said to be in an experimental stage, as nearly all the cars have been made by the traction companies themselves, but their success wherever they have been introduced will probably compel the regular manufacturers to take up the matter before long. The introduction of an innovation of this kind must necessarily be somewhat slow, as there is probably no custom of any community which is so regulated by conservatism as that relating to the disposal of the dead; but the reported daily use which comes from Chicago indicates that already there are many persons who prefer the comfort and convenience of the service to the conventional hearse and its accompanying "procession." The funeral car seems to be peculiarly adapted to the use of the larger cities, where the cemeteries are usually located in the suburbs and at a considerable distance from the majority of the residences. Where this distance is several miles every consideration points to the use of the trolley car in preference to the carriage. In the city of Mexico funeral cars, run by horses, have been in use for a long time, and the returns last year from this service were as much as $80,000, in the currency of the country, or nearly 5 per cent of the gross receipts. It may take a long time to introduce the system to any extent in this country, but it is a step in the right direction, and is worthy of serious consideration.

The attention of street railway managers may well be given to the admirable work done by Allen Ripley Foote during the past three or four years in pointing out and codifying certain important principles which should govern contracts between municipalities and public service corporations, such as street railway, electric lighting and gas companies, etc. This work appears in excellent form in a series of bills prepared by Mr. Foote at the request of the Ohio State Board of Commerce for presentation to the Ohio Legislature at its last session, and while action upon these bills was deferred until the next session, it is expected that they will be taken up for consideration next winter.

The essential provision of these bills are as follows:

1. Bonds issued by a municipality for the establishment of a public service plant shall be secured only by mortgage of the plant itself and the franchises for operation. In other words, the general credit of the city shall not be placed behind these bonds, but they must stand or fall upon their own merits and earning power.

2. No public service owned by a municipality shall be sold for less than cost. If the service does not pay at the prices originally established, these prices must be increased. The general body of taxpayers must not be called upon to help pay for a service to a private user.

3. The true and entire cost of service, whether given by a private company or by the municipality, shall be determined by a State Auditing Department, to be established, and shall include the following terms:

a. The full operating expenses.

b. A sufficient provision for depreciation, for losses from fire, and for accidents of every kind.

c. Taxes paid (in the case of private companies) or relinquished (in the case of municipalities), these taxes including any special bargains concerning franchise taxes which may be made between municipality and company based on a payment of percentages on gross receipts.

d. Interest on the full amount of actual investment at the rate per cent paid by the municipality on its bonded debt.

4. To the cost of service as above specified, there shall be added in the case of enterprises owned and operated by the municipality a provision for a sinking fund sufficient to pay off at maturity the bonds issued on investment account.

5. All surplus earnings over and above the true cost of

service, as defined in paragraphs 3 and 4, are to be regarded as the true profits of the enterprise.

6. Out of these true profits, when earned by a private company, the latter may pay upon its true investment a rate per cent double that paid by the municipality on its bonds.

7. If a private company adopts a system of profit sharing with its employees, it shall be entitled to earn and pay to the employees the same rate per cent upon the wages earned by them as the company earns on its investment

8. All surplus profits, after making the distributions provided for in paragraphs 6 and 7, are to be divided equally between the municipality and the company.

9. The determination of the investment value to be used as a basis for the foregoing computations shall be determined originally by appraisement or by arbitration. Additions shall be made in a manner specified by the municipality.

10. The price for service to be paid by users shall be fixed by the municipal council for a period not less than five nor more than twenty-five years, and the prices so fixed shall be computed on the basis of cost, and must be such as to produce an annual revenue sufficient to fully pay all costs and to yield the company its authorized share of profit.

The above programme is clear, logical, and seems to be fair to all parties in interest. It embodies many of the principles which we have several times recommended to street railway companies which have short time, imperfect or otherwise unsatisfactory contracts with municipalities at present, and we believe that where such a programme is adopted there will be a cessation of friction between the municipality and the companies. The difficulties in the way lie in the opposition of the professional politicians, who do not, as a rule, care to see a permanent settlement of these questions, but prefer to have them left open for possible "strikes" when the political exchequers are low. The public in general, however, will be greatly benefited by contracts of this character—far more so than will be the case where municipal ownership, with all its crudities and imperfections, is adopted, and many of the most intelligent and fair-minded of the advocates of municipal ownership grant that the principles above laid down would be satisfactory to them as a substitute.

Concerning Tractive Resistances

Despite all that has been written upon this very important topic, engineers are still confronted with a degree of uncertainty as to the exact facts, which is anything but comforting. It is the purpose of these lucubrations to exhibit the present state of general ignorance and to point out the line which experiments should take in order to clear matters up. In ordinary tramway practise the engineer takes his medicine, and says no more about it—the conditions change every time the street is torn up and repaved or resurfaced by a new gas company or an overzealous street department. When, however, he is confronted by the problem of planning a high-speed line, and proceeds to look up the available data on train resistances, he finds himself up against a pretty tough proposition. Suppose one starts by assuming a 100-ton train and a speed of 100 miles per hour, and takes the data now available, what conclusion will he reach? Passing by some of the earlier formulæ, we will start with the well known results of Wellington, founded upon a legion of experiments. Taking our train as composed of five cars, we set gaily to work, and promptly get out a tractive resistance of no less than 97 lbs. per ton, which is equivalent to an output of 2586 hp. This is a cheerless outlook, indeed, so we make a mental reservation to the effect that Wellington's data do not quite represent modern results, and hunt up Barnes' formula, deduced from a large amount of high-speed work with locomotives. This seems pleasanter, giving as it does a net 20 lbs. per ton, just 533 hp for the job. But which is correct? It would be decidedly unpleasant to advise, say a 600-hp equipment, and then find that Wellington was right, and it would be annoying to build a 2500-hp locomotive and find it nearly five times larger than required. So, in this dilemma we look over the files of the STREET RAILWAY JOURNAL, and hunt out Lundie's results. They look reasonable, and applying them to the case in hand we find that 34 lbs. per ton is about right, calling in all for 907 hp. This seems more agreeable, and we are just settling down to a contented frame of mind when someone unkindly calls our attention to a batch of very careful tests made in France about fifteen years ago. We cannot entirely reject these, and, applying the resulting formulæ, find to our horror that 58 lbs. per ton is the figure indicated, and that we shall certainly need 1546 hp to pull that wretched train.

Now, bearing in mind that each of the formulæ represents the results of painstaking experiments, it certainly seems queer that they lead to results so discordant. To say what is true enough, that they are horrible examples of the dangers of extrapolation is begging the question, for what we really want to know is the reason why the formulæ seem to go crazy and talk nonsense as soon as they get out of sight of the experiments.

To begin with, train resistance is certainly a very complex variable, and to assume that it can be correctly represented over any considerable range by a linear, parabolic, or hyperbolic, relation between the co-ordinates, is altogether gratuitous. To analyze the total resistance roughly, it is composed of three separate elements, varying in relative importance as the speed varies. First comes the track resistance proper, *i. e.*, the resistance to dragging the turning wheels over a track which is far from being frictionless; second comes the drag of journal friction, which is comparatively simple; and finally the air resistance, more complex than either of the others. The first mentioned factor is the predominant one at all low and moderate speeds. The third at these speeds is rather small, but controls the situation at very high speeds. The second is, fortunately, tolerably stable and not large enough, ordinarily, to complicate the situation.

We may now further analyze each of these factors of the resistance. The track resistance is made up in the main of pure rolling friction, small and fairly steady; joint friction, rather large and variable; flange friction due to jarring and rocking of the trucks and to wind, large and exceedingly irregular, and finally, the work against gravity, due to irregularities and flexure of track, very variable and at times very large. It is impossible to define the exact relative importance of these factors, but it is safe to say

that the friction of bearings and the rolling friction of wheels upon track, particularly the last named, cut a rather small figure in the total. Their sum constitutes the principal component of train resistances at extremely low speeds, particularly in the case of long and lightly loaded trains. It probably does not exceed 3 lbs. per ton, to judge from the evidence of various investigations, and, perhaps, may be somewhat less. Moreover, it is likely to remain fairly uniform irrespective of speed. The flange and gravity components may be estimated roughly from the increment of the track resistance as the speed rises within moderate limits, for the air resistance in case of a heavy train is so small that while it cannot be neglected it is not likely to involve uncertainties considerable enough to introduce material errors. With a heavy train at 10 miles to 15 miles an hour the head pressure due to air resistance is unlikely to exceed about 1 lb. per ton, and the characteristics of the various formulæ indicate that at such speeds the factors we are examining have already exceeded the pure friction and probability range about 4 lbs. to 5 lbs. per ton. Their rate of increase is a very uncertain quantity, indeed. On a poor track the jarring and swaying increases rapidly with increased speed, and this must cause a very considerable rise in the amount of power required. On the other hand, a train upon a good, or fairly good, track sometimes seems to steady down at high speeds, so that it seems to run quite as smoothly at 60 miles per hour as at half that speed. While the real facts of the case have not as yet been ascertained, there seems to be considerable evidence that on the whole these resistances do not increase directly as the speed, but at a variable and finally decreasing rate, so that at very high speeds they are scarcely, if at all, greater than at 10 miles or 15 miles per hour. In other words, at very great velocity, the running gear, and perhaps even the track, works more smoothly than at low speeds. This view is borne out by the very extraordinary fact that of the comparatively few experiments at speeds above 75 miles per hour all give values of the total resistance so low as to leave no room for a considerably increased track resistance unless the air resistance is much smaller than there is the slightest reason to suppose.

Of the air resistance we have now considerable knowledge, enough to say with certainty that it does not increase as the square of the speed, but at a much less rate. Crosby's experiments, of course, show an almost linear relation between speed and air pressure, but these were made upon short bodies, no more than two or three diameters long. Now, the air resistance to a train is composed of two distinct parts—first, the head pressure, and second, the eddy or wave pressure along the sides. The first may reasonably be expected to obey some fairly simple law, but the second is an altogether unknown function of the velocity and length of the train. Now, even as regards the head pressure, while it is true that doubling the speed of a train doubles the amount of air per minute pushed aside by its front, there is a great deal of doubt as to the velocity acquired by the said air and the actual work expended upon it; and, when we consider the resulting eddies, unknown as to velocity and somewhat uncertain as to direction, it is small wonder that air pressure in general is a somewhat uncertain quantity. There is a strong probability that the value of the eddy resistance passes through a series of maxima and minima, as does the wave resistance of a ship, the values of these depending on the velocity, length of train and perhaps even the length of individual cars. Data bearing upon this phase of the subject are greatly needed.

In taking up the application of resistance formulæ to high-speed electric work, it must not be forgotten that motor gearing, if gearing be used, is a very material matter, and that if the number of motor-driven axles is considerable, an entirely new factor enters the calculation. There is some good reason to believe that the grinding friction of a driving wheel is entirely different from the rolling friction of a trailing wheel, so that where minimizing the power at high speed is the controlling consideration, the fewer driving axles the better.

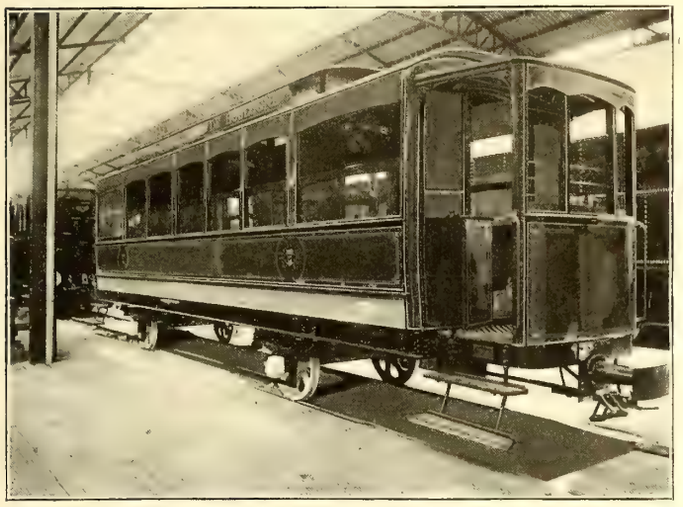
Now, all this is intended to point out as nearly as may be what are the uncertain factors in train resistances at the high speeds to which electrical traction must in the course of events tend, and to stimulate if possible the research that is necessary to finding out the conditions upon which success depends. There is much to be done, and many hands are needed to do it. First of all, it is desirable to get data on the values of the track resistances at various speeds. Second, we need, and need badly, a redetermination of the air resistances on a large scale; if possible, direct dynamometric measurement of the power required to tow at the end of a very long cable a car having a front of definite area and shape. Finally, the head resistance should be as far as possible differentiated from the eddy resistance by experimenting on trains of various lengths in some such manner as we have just indicated. With these data in hand it would be easy to deduce graphically the actual power required to drive a given train at any required speed within very wide limits. We say graphically because it is extremely doubtful whether any formula simple enough to be convenient for reference would represent the experiments with sufficient exactness. The facts of the case are necessary not only to determine the absolute power required, but to indicate the best means of supplying it. It is certain that very high speed traction must in the nature of things come, and the sooner preparation is made for it the better, for failure in the first serious attempt would not only be costly, but would have a discouraging effect on future work along the same line. Meanwhile it may be noticed that we have vouchsafed no solution of the hypothetical question we propounded at the start. The reason for such mental abstinence should by this time be tolerably clear. In the present state of the data we must firmly decline to hazard anything more authoritative than a guess—sometimes called an estimate by those who desire to appear wise in the eyes of their fellowmen. But our guess is that when the first well designed train of 100 tons is run at 100 miles per hour the total resistances will not exceed 20 lbs. per ton of weight.

The Grand Rapids Railway Company, Grand Rapids, Mich., has issued a neat little folder for the benefit of its patrons. A map of the system is given, but nearly the entire space is occupied by reproductions of views to be seen from the trolley cars. One page is devoted to the details of a trip around the city, which will give the passenger a chance to see the greater part of the city, with stopovers at the parks, for the sum of 20 cents.

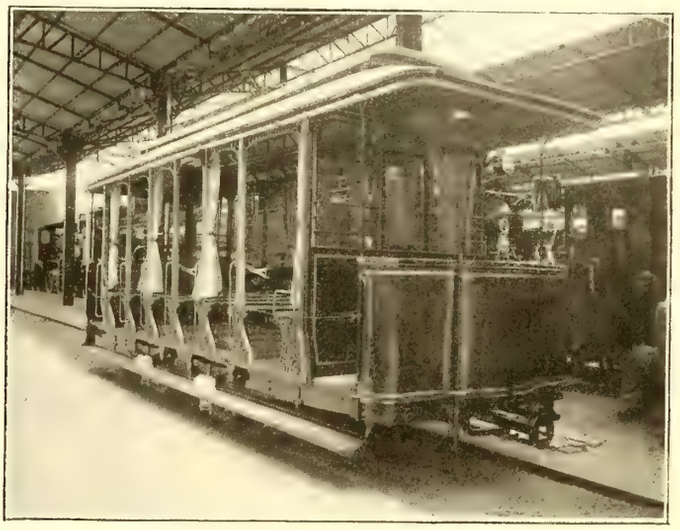
Paris Exposition Notes

[*From Our Regular Correspondent.*]

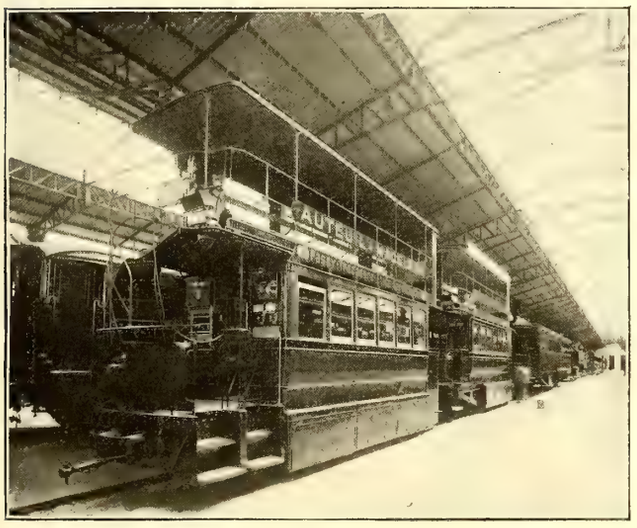
Since the last appearance of the STREET RAILWAY JOURNAL, the Transportation Exhibition, both on the Champs de Mars and at Vincennes, may be said to have been completed and put in such a shape that the visitor can at last make for himself a fairly thorough and comprehensive study of what is shown in each group. Best of all, the section of the official catalogue, which comprises Group 6, dealing with civil engineering and means of transport, has at last made its appearance in the shape of a bulky volume of several hundred pages, which, however, are not numbered consecutively. As the material under each of the several classes in the group is treated separately, however, the catalogue is easier for reference than might appear at first sight. Preceding the section which deals with Class 32, or material for railways and tramways, is a very interesting summary of the situation in France. A large part of this deals necessarily with steam railroads, but there is an interesting section of three or four pages which treats more particularly of street railways. There is also a little section which deals with what are called "railroads of local interest," or which, perhaps, in England would be called "light railways," using a narrow gage. Many of them are really rural street car lines. Of these light railways, it would appear that there were in France when the figures were compiled, about two years ago, 4200 km in operation and 563 km under construction. Under the head of tramways, the total mileage in operation, given under date beginning 1899, was 3282 km; while another table, as of 1898, gives in operation, 2908 km of different gages, and 1351 km under construction. It is worthy of note that of the mileage thus presented, 1988 km was of one meter gage in operation, and 1152 km under construction. It is stated that for the track the types of rail in use are Marsillon, Broca and Vignole, of weights varying from 14 kg to 48 kg per meter, while in cities where self propelling vehicles are used weighing as much as 20 tons a track weighing as much as 50 kg to the meter is in use. According to another table, at the beginning of 1899 there were in operation in France 317 km of street railway operated electrically, of which 298 km were overhead wire. These figures have, of course, been greatly increased since the data were compiled for the catalogue, and this is equally true of the professional and industrial census given, reported for 1896, when, it is stated, some 4400 persons in France were employed in building locomotives and materials for railways coming within this class. It would seem that the data could easily have been made more complete and closer to date, but in view of the inordinate lateness with which the catalogues have appeared we ought to be profoundly thankful that no such cause for further delay was interposed.



TYPE OF CAR ON BOIS DE BOULOGNE TRAMWAY, VINCENNES



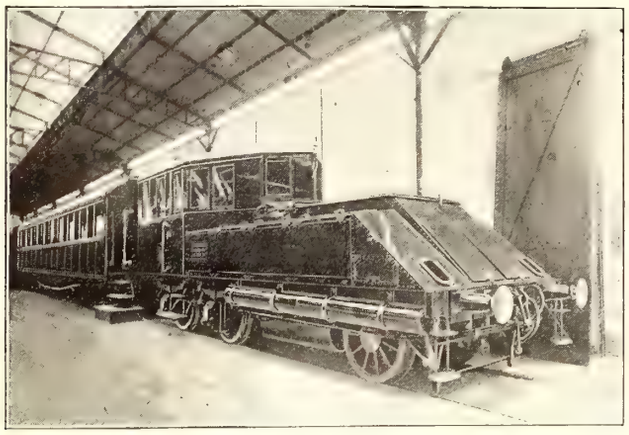
ITALIAN OPEN TROLLEY CAR, VINCENNES



COMPRESSED AIR CAR, PARIS GENERAL OMNIBUS CO., VINCENNES

RINGHOFFER, AUSTRIAN TROLLEY CAR, VINCENNES

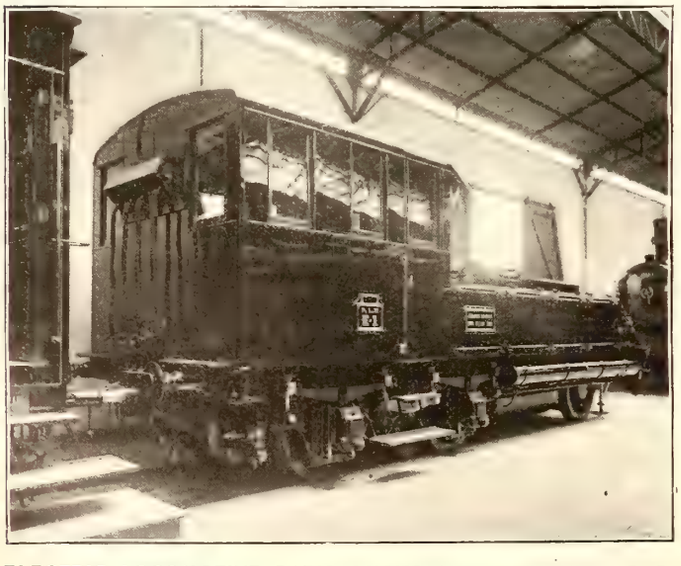
Taking up the catalogue as it stands, it would appear that there are nearly 500 exhibitors in Class 32, as follows: Japan, 2; Luxembourg, 2; Mexico, 2; Norway, 1; Holland,



END VIEW ELECTRIC LOCOMOTIVE, PARIS, LYONS, MEDITERRANEAN RAILROAD, VINCENNES

2; Peru, 1; Portugal, 4; Roumania, 2; Russia, 43; Servia, 1; South African Republic, 1; Sweden, 1; Switzerland, 7; Turkey, 1; France, 112; French colonies, 9; Germany, 25; Austria, 23; Belgium, 23; Bosnia, 1; Spain, 2; United States of America, 161; Great Britain, 24; Hungary, 28; Italy, 12, making a total of 490. Of these, a large proportion deal with street railway apparatus and material. It will be noticed that the United States makes a much larger numerical exhibit than France itself, but this is somewhat deceptive as to the space occupied, France exhibiting actual material upon the tracks, whereas the American material consists in a great many cases of official reports and volumes of transactions, or photographs and drawings.

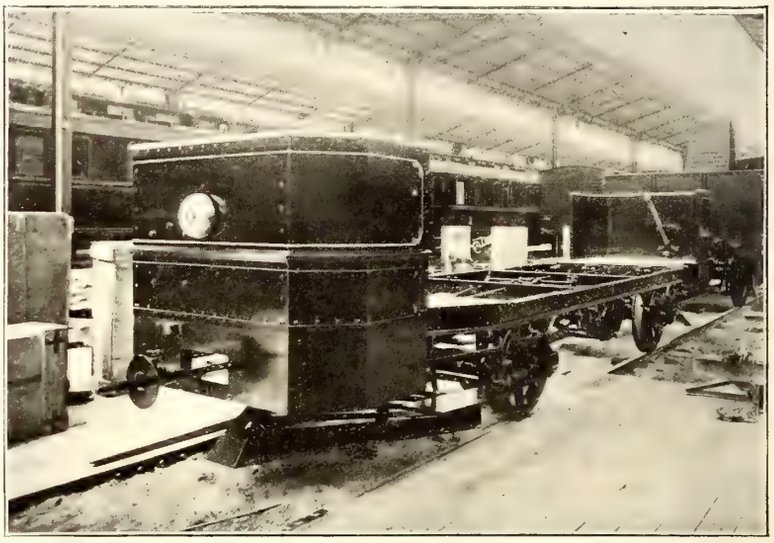
A great many views of the apparatus installed both in the Transportation Building of the Champs de Mars and at Vincennes have already been presented in the pages of the Street Railway Journal, pending a more elaborate and complete discussion, and a few others are now forwarded



ELECTRIC LOCOMOTIVE, PARIS, LYONS, MEDITERRANEAN R. R.

herewith. A liberal exhibitor in the French class is the Companie Générale des Omnibus de Paris, which exhibits a street railway car operated by accumulators, one of the steam type, one with an oil engine, and one of the compressed-air type. Some of these have been shown already, and a view is presented herewith of the compressed-air cars operated by this company. The air is stored at a pressure of 80 kg. per cm² in a reservoir below the floor of the car, and is reduced to 15 kg. per cm² before use in the motor. This ponderous double-deck car and its associate are in sharp contrast to the lighter recent types of trolley car and trailer, especially those of the single-deck type shown in the sample of car built for the Bois de Boulogne. This heavy compressed air car is also in sharp contrast with the light open trolley car, of which a view is here shown, built by Miani Silvestri & Company, of Milan, which is brought to notice in the Italian section on the tracks at Vincennes, and which is characterized by considerable lightness and grace of design. This concern is well known as a builder of rolling stock in Italy, and its name and material will be more or less familiar to readers of the Street Railway Journal. Another very interesting and handsome trolley car not included in the last batch sent of foreign exhibits at Vincennes is that shown in the Austrian section by F. Ringhoffer, of Prague, with a bent-loop trolley, as shown in the photograph.

The Miani Silvestri car is 7.84 m in length, and carries



TRUCK OF GANZ ELECTRIC LOCOMOTIVE, VINCENNES

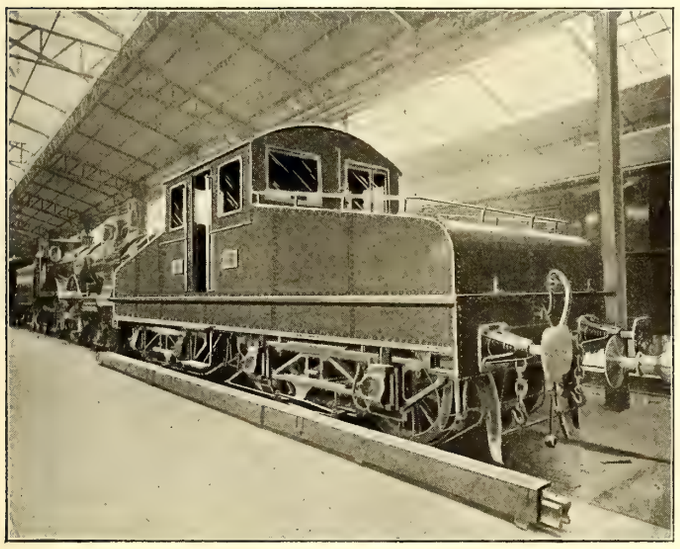
two General Electric motors of 25 hp each. It affords thirty-five seats, and the back rails of all but the end benches are reversible. The Ringhoffer car seats twenty-four passengers, and has standing room for eleven. It carries two motors of 25 hp each, of the Siemens-Halske make.

In previous correspondence no note has been made of the electric locomotives or locomotive trucks on view at the Vincennes part of the Exposition. It is well known that the various steam railroads of France have been experimenting in the direction of the utilization of electricity on their lines, particularly on urban stretches and around their terminal depots. And this is an important subject which demands more space than can be here given it, while so far very few details have been given out as to the actual construction and operation of the locomotives themselves, with which, it would appear, some very exhaustive tests are being made. During the earlier stages of the work on Electricity Building, the Railroad of the North had a very handy and effective little storage battery locomotive, with which a good deal of work was done, hauling and pushing carloads of exhibits into position along the temporary tracks through the building, and this in itself constituted a striking demonstration of utility in this branch of locomotion. But the machines on view at Vincennes are of a far more imposing character. Views of some of them are presented herewith, such as that of the Paris, Lyons & Medi-

terranean Railroad, that of the Paris-Orleans Railroad, and the truck exhibited by the Ganz Company, of Budapest.

The Ganz truck is in reality that of a motor car of ordinary size, but it has a lever brake. The total length is 8.26 m, and 3.10 m between centers of axles. It carries two motors of 25 hp each. The locomotive of the Paris, Lyons, Mediterranean Railroad, however, is something serious, as will be seen from its length and bulk. It is, moreover, equipped with two motors of 225 hp each, able to exert, it is said, between 500 and 600 hp.

With regard to the electric locomotive of the Orleans Railroad, its resemblance to those employed at Hoboken, N. J., and in the Baltimore Tunnel, will be at once noted by every American reader. It is due to the French Thomson-Houston Company, a fact which will account for its construction on these approved lines. It may not be generally known that the Orleans Railroad, which at present has its terminal at the very outskirts of Paris, and has therefore been most inconvenient to reach, has lately pushed its way nearer to the heart of the city and has erected a magnificent new station on the Quai d'Orsay. This prolongation of its track is 2½ miles in length, which will give an idea of the distance to be saved by the great majority of those who use the road. Over this stretch of track eight electric locomotives are to be used, of the type



FRENCH THOMSON-HOUSTON ELECTRIC LOCOMOTIVE, ETC., PARIS-ORLEANS R. R.

shown, and they have already been tested for their work in situ. Each locomotive has four driving axles with a motor in each, and weighs about 45 tons. These motors are of the G. E. 55 type, of 175 hp each. Each locomotive is easily capable of hauling passenger trains from the old station to the new in seven minutes, each train being estimated at about 250 tons. It is stated that 150 such trains will be hauled per day to and fro. The trains will arrive at the outer terminus under steam power, and a change of locomotive will be effected in two minutes. Current is to be generated at high tension and then delivered by two sub-stations—one at the Quai d'Orsay and the other at the Quai d'Austerlitz, where the old depot stands. The local current distribution system comprises a third rail external to the track and an overhead contact in the tunnel at the entrance to the Quai d'Orsay, so that each locomotive is provided with three sliding-shoe collectors and with two overhead trolleys, for the double service. Fuller details of all this highly important work will be given at the proper time.

In the immediate vicinity of this compact looking electric locomotive are a great many steam locomotives of the highest state of development, and the contrast both in shape and in mechanism naturally attracts a great deal of attention. It is not alone in electric locomotives that the initiative may be said to be due to American practise, for only the other day quite a dispute arose in the Chamber of Deputies owing to the fact that in one of the State railroad exhibits at Vincennes an American steam locomotive was

ELECTRIC LOCOMOTIVE FOR PARIS-ORLEANS R. R., VINCENNES

shown in all its glory, whereupon the inquiry arose why French locomotives were not good enough for systems in which the State itself had an interest. It is not to be understood that France or any other power of Europe is about to adopt the American style of locomotive, electric or steam, but there is no question that American practise as exemplified at this exposition is destined to have a great influence.

Compressed Air Cars in New York

Considerable interest has been aroused by the proposal of the Metropolitan Street Railway Company, of New York, to change the type of compressed air motors in use on its Twenty-Eighth and Twenty-Ninth Streets Railway. Reference has already been made to the fact that the Hardie motors are to be used on this line in place of the motors which have been employed, and which were described at length in the STREET RAILWAY JOURNAL for June, 1899. The reasons for this change can best be explained by a brief history of compressed air traction in this country during the last three years. About three years ago two manufacturing companies were making vigorous efforts in New York to solve the problem of the application of compressed air to street car service. One of these was the General Compressed Air Company, which was operating three motor cars on the 125th Street line of the Third Avenue Railroad Company; the other was the Compressed Air Power Company, which was owned largely by some of the principal stockholders of the Metropolitan Street Railway Company. These gentlemen were induced to become interested in compressed air traction, largely by the hope that independent compressed air cars could be used on the cross-town lines of the Metropolitan Street Railway Company, on which the installation of the underground conduit was practically out of the question on account of expense, and on which the installation of the overhead trolley was prohibited by the municipal authorities.

The motors used by the two systems mentioned, and which were popularly known respectively as the Hardie and Hoadley systems, were alike in that a high pressure, *i. e.*, 2000 to 2500 lbs. per square inch was carried in the air reservoir, but differed in practically every other respect. In the Hardie system, two long stroke (14 ins.) single expansion engines were carried on the car truck and drove

directly the wheels of one axle of the car, the other axle being connected to the driven axle by side rods. The Hoadley motors on the other hand were patterned more after an electric motor, so far as the application of the power was concerned. Each motor, of which there were two on each car, was of the compound type with short stroke (6 ins.), and drove a shaft carrying a pinion which in turn was geared to the car axle. The two axles were thus driven independently, the motors ran in oil, and the whole equipment did not differ very much in external appearance from an electric equipment. There were a great many other variations in practise between the Hardie and Hoadley systems, as in the method of reheating, etc., but those already mentioned are sufficient to characterize the two systems as radically different.

The satisfactory results secured by the Hardie motors on the Third Avenue line, as mentioned above, convinced the managers of the Metropolitan Street Railway Company that the patents of the General Compressed Air Company were essential in securing the best results in compressed air motor work. As a consequence, negotiations were entered into by which a new company, the American Air Power Company, was formed to consolidate the interests of the other two. The Metropolitan syndicate controlled the new company, and though certain modifications were made, the general characteristics of the systems used on the Metropolitan line remained the same, that is, the compound short stroke motor driving the two axles independently. Soon after the consolidation, the services of Robert Hardie were secured by the Compressed Air Motor Company, which was a licensee for Wisconsin and Illinois of the General Compressed Air Company, and whose stockholders still believed in the "locomotive" principle, as applied to compressed air traction. The scene of the competitive trial between the two systems was now transferred, the American air power motors being used in New York, while the Hardie motors were employed in Chicago. The Chicago motors were used on the North Clark Street road, to operate between 12 o'clock at night, when the cable of that line shut down, and 6 o'clock next morning, when the cable was again put in operation. The motors gave good satisfaction and frequently hauled a trail car, and sometimes two trail cars, with a total of 300 passengers on a train. The results secured were so much more satisfactory than those in New York that the Metropolitan syndicate decided that if success was to be secured in the latter city, it would have to be, by following the Hardie system as employed in Chicago. Negotiations were then entered into between the American Air Power Company and the Compressed Air Motor Company for a second consolidation of interests, and resulted in the organization of the Compressed Air Company, with Mr. Hardie as chief engineer for the consolidated company. Henry D. Cooke, the president of the Compressed Air Motor Company, was also elected president of the new company. This has resulted in the retirement of the old equipment on the Twenty-Eighth and Twenty-Ninth Streets lines, and the placing of an order by the Metropolitan Street Railway Company for the equipment of the line with the Hardie motors. The new motors for the Twenty-Eighth and Twenty-Ninth Streets lines are now being built, and will be in operation at an early date. It is the purpose of this article to describe the system as it will be employed on this road, as fairly representing the best American compressed air practise at the present date.

FIG. 1.—COMPRESSED AIR MOTOR CAR AND TWO TRAILERS, NORTH CLARK STREET, CHICAGO

The compressing station is located at the foot of West Twenty-Fourth Street, New York, western terminus of the line, and was fully described in the Street Railway Journal for June, 1899. It contains a 1200-hp engine, operating directly four-stage Ingersoll-Sergeant air compressor, with a capacity of 56,735 cu. ft. of free air per revolution, and compressing to 2500 lbs. per sq. in. This air is stored in a series of reservoirs of seamless tube flasks in the car house, from which the reservoirs on the cars are charged.

There are sixteen reservoirs on the cars, having an aggregate capacity of 55 cu. ft., and weighing 4340 lbs. Fourteen of these reservoirs are carried on the truck, and one under each seat. From these reservoirs the air passes into one common header, and from this header is a pipe passing to each end of the motor car. The flow of air through this pipe is regulated by a stop valve under the control of the motorman. When the motorman opens the valve at either end of the car, the air, which is still under 2500 lbs. pressure, passes from the valve to the reducing valve.

The reducing valve is illustrated herewith, and automatically keeps the working pressure uniformly at about 150 lbs. per sq. in., whether the storage pressure is at its maximum or its minimum or at any intermediate point. As will be seen, the reduction valve is balanced by a hydraulic packed piston (shown below the reduction valve) in such a way that a variation in the storage pressure, as would be experienced during a trip, does not affect the operation of the valve. Ordinarily, double valves are used for this purpose, but these rarely give a constant reduced pressure, with a variable high pressure; they also give trouble by leakage. As will be seen, there is a spring which tends to open the reduction valve, and whose pressure is balanced by a flexible disc, upon which the reducing pressure acts, tending to close the reducing valve. When this reduced pressure reaches a point sufficiently high to compress the spring, it seats the valve automatically.

The cap which closes the opening through which the valve is passed into its place is also a cylinder, in which is another hydraulic packed piston. The object of this piston is to enable the motorman to increase the working pressure for starting quickly from a state of rest. Its operation is as follows: A pipe connects the space *A* with the motor-

man's brake valve, and when the brake handle is moved to a certain position it bleeds the air from pocket *A*. The working pressure then acts on the under side of this piston to assist the spring in opening the valve. It now requires a higher pressure acting on this disc to close the valve against the combined resistance of the spring and this piston, which higher pressure enables the motor to start quickly. As soon as the motor has acquired the necessary speed, the motorman moves the brake handle to the normal running position, which restores the working pressure in the space *A*, so that the piston is now in equilibrium

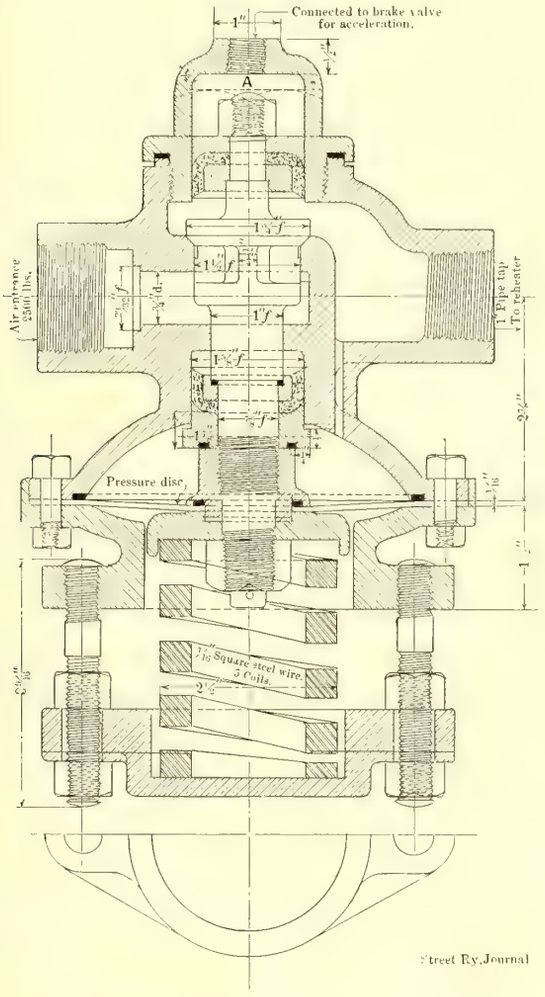


FIG. 2.—SECTION OF REDUCING VALVE

and the normal working pressure is now sufficient to close the valve against the spring and keep the motor in operation.

It will be noticed that the valve itself is connected by ribs or wings to a collar on the valve stem. This is done as a matter of safety. Should the valve stem break at any point under this collar, the entering high pressure would immediately open the valve, but the collar entering the seat prevents a dangerous rush of air into the working pressure reservoirs and pipes. It will also be noticed that the follower of the equalizing piston has a shoulder which will permit of 1-16 in. movement of the valve in ordinary working, so that the safety collar can never enter the seat unless the valve stem breaks.

After passing through the reducing valve, the air is at working pressure of 150 lbs., and is then led to the reheater, which is placed in the middle of the truck. This reheater contains about 500 lbs. of hot water, the temperature of which at the start is about 320 deg. F., but during a trip this temperature falls sometimes as low as 170 deg The air is passed into the bottom of this heater and escapes into the water through a perforated pipe lying along the bottom of the heater. When the reservoirs need to be recharged with air, and the car is run to the charging station for this purpose, steam is passed through this same perforated pipe to reheat the water.

During its passage through the water, the air is heated to the temperature of the water, and is then drawn off at the top through the perforated pipe *T*. The baffle plates shown are to prevent a swash of water caused by the car oscillation.

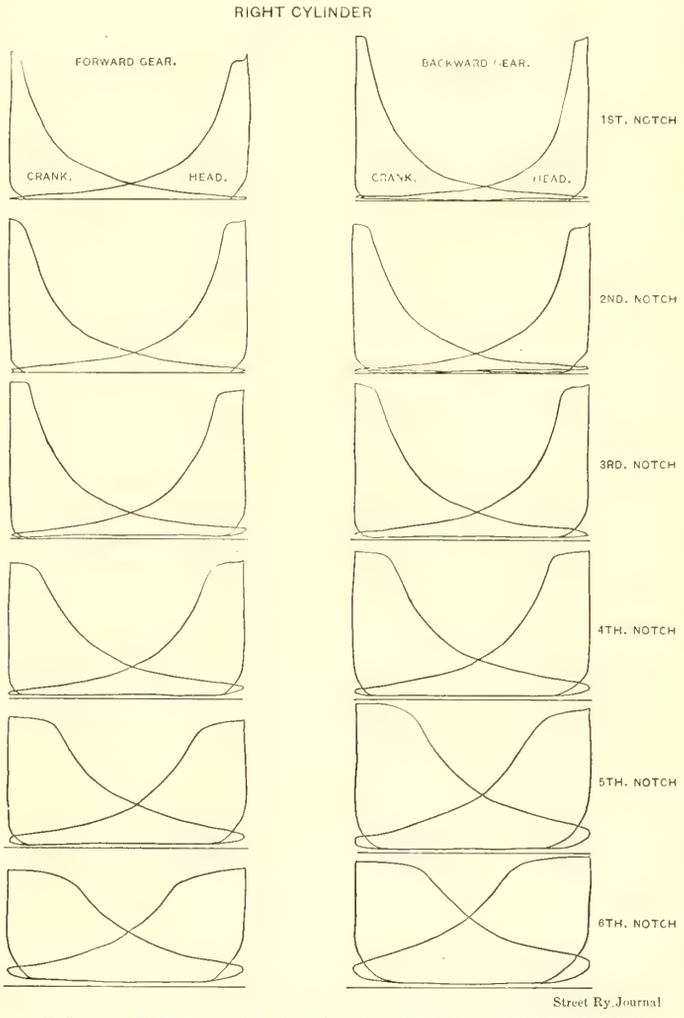


FIG. 3.—TYPICAL INDICATOR DIAGRAMS AT DIFFERENT NOTCHES

The efficiency of reheating is illustrated by the following test: A motor was run two trips, as far as possible each trip, on a full charge of air, first without heat and afterward with heat, covering 8 miles and 15 miles respectively; showing that the additional 7 miles were obtained from the heat, and careful measurements showed that the amount of heat used was 98,000 heat units. In ordinary practise, from 10 to 12 lbs. of coal will supply this amount of heat to generate steam in steam boilers. As this amount of steam injected into the water in the heater will restore the 98,000 heat units, it follows that the additional 7 miles were obtained on an equivalent of from 10 to 12 lbs. of coal.

Returning now to the cycle of operations, the air, which is now at about 150 lbs. pressure, and at a temperature of about 320 deg. F., passes from the perforated exit pipe *T* to the throttle valve of the motor, and thence to the valve chest of the engine in exactly the same way as steam in a steam engine.

The valve chest of the engine cylinders contains two valves, one the distribution or main valve, and the other the cut-off valve. These valves are operated in such a man-

ner that any degree of cut-off can be obtained, as illustrated by the indicator diagrams. Compressed air has this advantage over steam, that it does not condense during expansion in the engine cylinder. Therefore, expansion may be carried with economy clear down to atmospheric pressure. To do this in a steam engine would cause what is

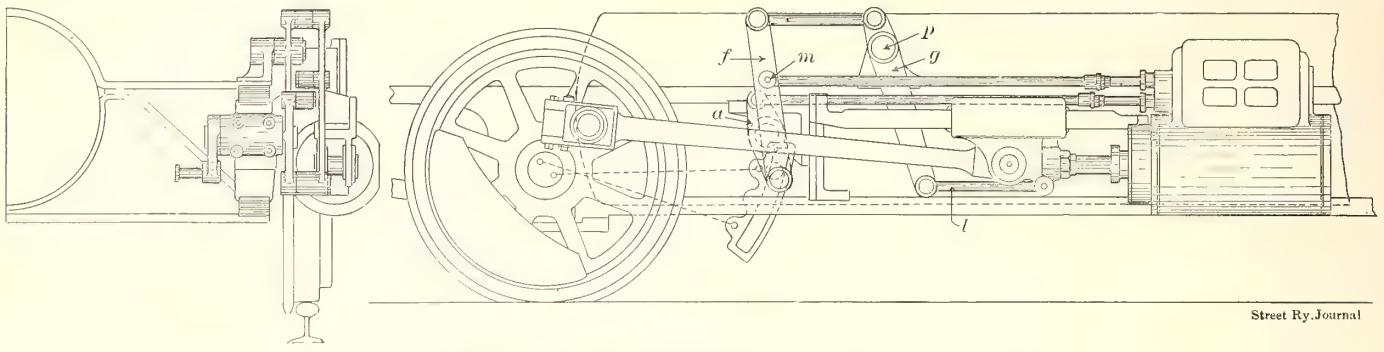
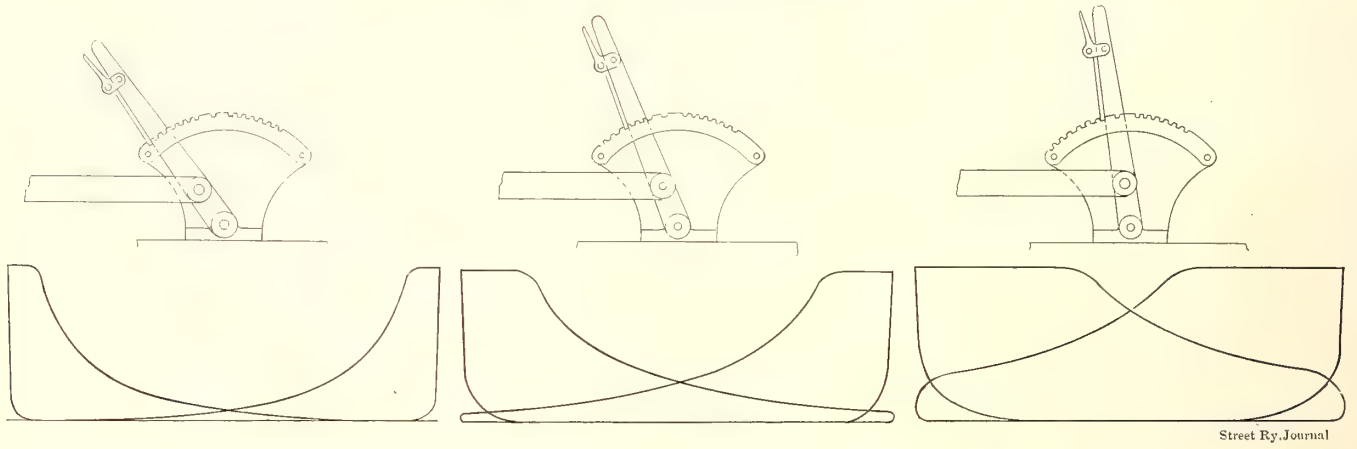


FIG. 4.—DIAGRAM OF ENGINE CYLINDER, SHOWING VALVE GEAR

RESULTS OF DISTRIBUTION OBTAINED BY HARDIE VALVE GEAR FOR THREE POSITIONS OF LINK, WITH 3-16 IN. INSIDE AND OUTSIDE LAP OF MAIN VALVE AND 11-16 IN. NEGATIVE LAP OF CUT-OFF VALVE
ADMISSION PORTS 2½ INS. X ⅝ INS. CYL. 6½ INS. X 12 INS.

First Position. Main Valve (Full) Travel 2 in.; Cut-off Valve Travel 2 in.							Second Position. Main Valve Travel 1½ in.; Cut-off Valve Travel 1 11-16 in.						Third Position. Main Valve Travel 1 in.; Cut-off Valve Travel 1½ in.					
Crank Angle	Cut-off Valve Opening		Main Valve Opening		Piston Travel		Crank Angle	Cut-off Valve Opening		Main Valve Opening		Piston Travel		Crank Angle	Cut-off Valve Opening		Main Valve Opening		Piston Travel	
	Front	Back	Front	Back	Front	Back		Front	Back	Front	Back	Front	Back		Front	Back	Front	Back	Front	Back
Deg.	In.	In.	In.	In.			Deg.	In.	In.	In.	In.			Deg.	In.	In.	In.	In.		
0	15-16	⅞	7-32	7-32	.0	.0	0	1	1 1-16	5-32	5-32	.0	.0	0	1 1-16	1⅛	⅛	7-64	.0	.0
10	21-32	19-32	⅜	⅜	.11	.08	10	13-16	⅞	¼	9-32	.11	.08	10	15-16	1	5-32	5-32	.11	.08
20	11-32	5-16	½	½	.42	.31	20	9-16	19-32	11-32	⅜	.42	.31	20	13-16	29-32	7-32	7-32	.42	.31
30	0	0	⅝	21-32	.94	.67	30	5-16	⅜	7-16	7-16	.94	.67	30	21-32	¾	¼	9-32	.84	67
40	— ¼	— ¼	11-16	¾	1.61	1.20	40	⅛	5-32	15-32	15-32	1 61	1.20	40	17-32	19-32	¼	5-16	1.61	1.20
50	— ½	— 15-32	¾	27-32	2.46	1 83	*50	— 3-32	— 1-16	9-16	19-32	2.46	1.83	50	⅜	7-16	¼	5-16	2.46	1.83
60	— 11-16	— 23-32	¾	⅞	3.39	2.62	60	— ¼	— ¼	9-16	19-32	3.39	2.62	60	¼	5-16	¼	5-16	3.39	2.62
70	— ⅞	— 29-32	¾	15-16	4.44	3.48	70	— 7-16	—13-32	9-16	⅝	4.44	3 48	70	⅛	5-32	7-32	5-16	4.44	3.48
80	—1 1-32	—1 1-16	¾	15-16	5.47	4.45	80	— 9-16	— 9-16	½	9-16	5.47	4.45	80	0	0	3-16	5-16	5.47	4.45
90	—1 3-32	— 1⅛	11-16	⅞	6.53	5.48	90	—21-32	— ⅝	7-16	½	6.53	5.48	90	—1-16	—1-16	5-32	9-32	6.53	5.48
100	— 1⅛	— 1⅛	21-32	25-32	7.55	6.54	100	—11-16	—21-32	⅜	7-16	7.55	6.54	100	— ⅛	—3-32	3-32	3-16	7.55	6 54
110	—1 1-32	—1 3-32	⅝	21-32	8.54	7 56	110	—21-32	— ⅝	5-16	⅜	8.54	7.56	110	—5-32	—3.32	1-64	⅛	8.54	7.56
120	— 15-16	— 31-32	13-32	½	9.39	8 62	120	—19-32	— 9-16	¼	9-32	9.39	8 62	120	—5-32	—3-32	— 1-16	1-32	9.39	8.62
130	— 25-32	— 27-32	9-32	5-16	10.17	9,54	130	— ½	— 7-16	3-32	⅛	10.17	9.54	130	— ⅛	—1-16	— ⅛	— 3-32	10.17	9.54
140	— ⅝	— 11-16	⅛	5-32	10 81	10 39	140	— ⅜	— 5-16	— 1-32	— 1-32	10.81	10.39	140	—3-32	0	— 3-16	— 5-32	10.81	10.39
150	— 13-32	— 15-32	— 1-32	— 1-32	11.33	11.06	150	— 9-32	— 5-32	— 9-64	— 5-32	11.33	11.06	150	0	3-32	— 9-32	— 9-32	11.33	11,06
160	— ⅛	— 7-32	— 7-32	— 7-32	11.70	11.58	160	— ⅛	— 1-32	— ¼	— 9-32	11.70	11.58	160	1-16	3-16	—11-32	— ⅜	11.70	11.58
170	⅛	3-32	—13-32	— ⅜	11.93	11.89	170	1-16	5-32	— ⅜	—13-32	11.93	11 89	170	⅛	9-32	—13-32	— 7-16	11.93	11.89
180	15-32	13-32	— 9-16	—19-32	12.00	12.00	180	5-16	⅜	— ½	—17-32	12 00	12.00	180	7-32	5-16	—15-32	—15-32	12.00	12.00

* Cut-off at 47 deg. Average piston travel, 1.91 in.



Main cut-off and compression crank angle, 148 deg.
Lead angle of crank—front, 12 deg.; back, 12 deg.
Point of cut-off, not including clearance, $\frac{1}{14.81}$ of stroke
Point of cut-off, including clearance, $\frac{1}{9.54}$ of stroke
Greatest port opening, 7-16 in.
Relative travel of main and cut-off valves, 3⅝ in.

Main cut-off and compression crank angle, 138 deg.
Lead angle of crank—front, 13 deg.; back, 13 deg.
Point of cut-off, not including clearance, $\frac{1}{6.29}$ of stroke
Point of cut-off, including clearance, $\frac{1}{5.19}$ of stroke
Greatest port opening, ⅜ in.
Relative travel of main and cut-off valves, 2 11-16 in.

Main cut-off and compression crank angle, 117 deg.
Lead angle of crank—front, 18 deg.; back, 18 deg.
Point of cut-off, not including clearance, $\frac{1}{2.42}$ of stroke
Point of cut-off, including clearance, $\frac{1}{2.29}$ of stroke
Greatest port opening, 9-32 in.
Relative travel of main and cut-off valves, 1⅝ in.

The variation of cut-off is effected by changing position of reverse lever (see above sketches), and grades of cut-off are obtainable between those given in the tables, the earliest grades being when lever is full over, so as to give valve full throw. In this position there is also the greatest amount of lead. Cut-off, including clearance, means piston travel at cut-off + clearance / stroke of piston + clearance; clearance in cylinder, 4 per cent.

Inside and outside lap being equal, main valve cut-off and compression take place at the same point.

The greatest port openings noted above are taken at the point where cut-off and main valve openings are equal, the cut-off closing while the main valve is opening. In the earlier grades this takes place near beginning of stroke when piston is moving slowly, and in the later grades when motor is moving slowly. There is always ample exhaust opening.

Readings were taken at equal crank angles for convenience, but valves would be set to cut-off at equal piston movements from each end of cyl.

known as cylinder condensation. Steam engines are compounded principally to reduce this cylinder condensation to a minimum, but this is not necessary with compressed air.

It was necessary to contrive a valve mechanism which would not be too complicated to operate, and yet obtain the best results. The valve mechanism which is attached to these motors is illustrated in Fig. 4. The usual Stephenson link motion is used to operate the main valve, but on the outside of the link there is an arm *a*, looking down as well as up. At the lower end of the lower arm is attached the lower end of a floating lever, *f*. The upper end of lever *f* receives a reduced motion, which is the opposite of the piston, through the lever *g* and link *l*, lever *g* being pivoted by a bracket attached to the frame at the point *p*. It will be observed that the lower end of floating lever *f* receives a motion directly the opposite of the main valve, and that its upper end has a motion directly the opposite of the piston rod. This lever *g* is attached to the cut-off rod at the point *m*, and gives to the cut-off valve a motion which is the resultant of the other two. The consequence is that when the main valve is traveling in full gear, the cut-off valve is also traveling at its longest stroke, and gives the earliest cut-off. When, however, the link motion is "cut back" so as to reduce the motion of the main valve, it gives a later cut-off. The indicator cards, shown in Fig. 3, indicate the effect of this. The first notch indicates the full travel of both valves, and each succeeding notch a reduced travel of both valves, showing a later cut-off. It will be observed that the latter grades show some terminal pressure which produces an audible exhaust, but these grades of cut-off are used only for starting the motor, and the lever is immediately moved to a position corresponding with either of the first three notches, according to the power required, which depends upon the loads and grades. It will be observed while cutting off at the earlier notches there is a freer exhaust, which will more readily free the cylinder when going fast. In the ordinary locomotive the cutting off is effected by the link motion only, with the result that the exhaust openings are diminished.

It will also be observed that the various grades of cut-off within the control of the motorman are effected by the same lever which reverses the motion, thus simplifying the operation of the motor very materially, and bringing it within the comprehension of the average street railway employee.

The weight of the entire equipment is said to be practically the same as an electric equipment, and all parts are flexibly supported on the axle box by means of four semi-elliptical springs, after the most modern locomotive practise. This support is entirely separate from that of the car bodies, which are carried on a different set of springs resting on the frame of the truck. In this use of flexible suspension, the system differs radically from the former air motors used on the Twenty-Eighth and Twenty-Ninth Streets line, where the case carrying the motors rested directly on the axles.

There remains now only one portion of the equipment to be described, *i. e.*, the air brakes. The air brake cylinder is illustrated in section in Fig. 6. In applying the brakes air is admitted to the annular space *R*, around the hollow piston rod, and to release the same air is made to pass to the other side of the piston from *T* around through *V*, thus equalizing on both sides of the piston. Having a larger area to act upon on the other end, the brake is released at once, the air escaping silently through the small opening

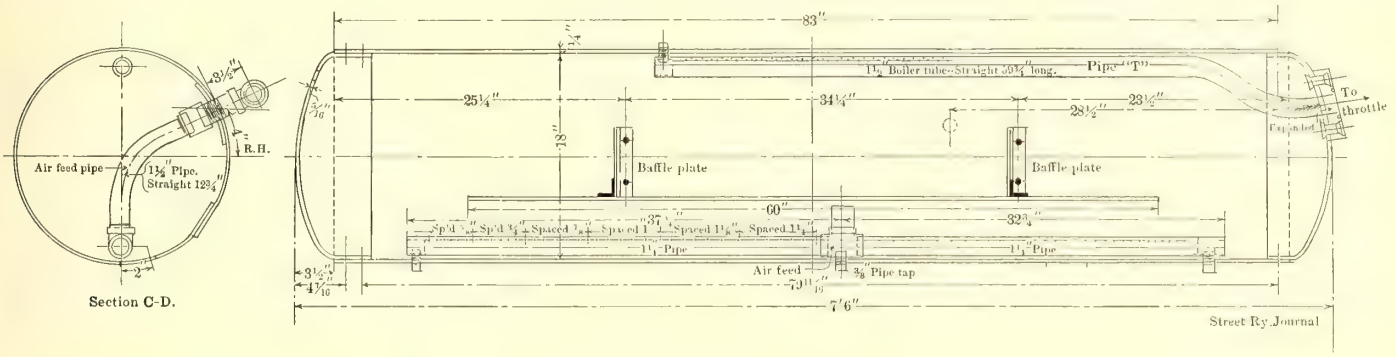


FIG. 5.—SECTIONS OF REHEATER

S, and out to the atmosphere through the openings at *W*, at the end of the plunger.

The Twenty-Eighth and Twenty-Ninth Street railway is now being operated by horses pending the change from the Hoadley-Knight to the Hardie motors. There is every reason to expect that these new motors will be successful, because Mr. Hardie has had more experience in this line than any other engineer in the United States, and has made the subject a special study for years. He has, moreover,

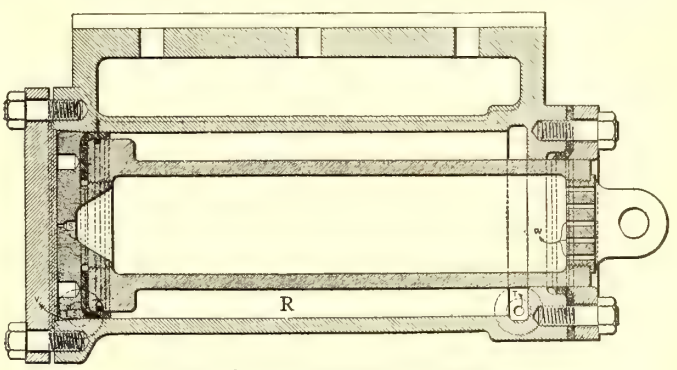


FIG. 6.—AIR BRAKE CYLINDER

held many responsible positions, and stands high in the profession. His standing among engineers is well expressed in the following extract from *Compressed Air*: "His mechanical ideas are marked by much individuality, the elements of simplicity being prominent. It is doubtful if any one has had as much experience as Mr. Hardie in pneumatic traction, and he is the acknowledged authority on the subject."

The work of transforming the Lexington Avenue line in New York from a cable to an underground trolley road is completed between 105th Street and Twenty-third Street. The final change from cable to trolley, however, is not to be made until the work is finished in Broadway, as the managers of the Metropolitan Street Railway Company believe the patrons of the road would not relish a change at Twenty-third Street from the trolley cars to the cable car in Broadway. The Columbus Avenue line is now being changed, and President Vreeland believes that both the east and west side cable lines and the Broadway line above Twenty-third Street will be finished by Nov. 1.

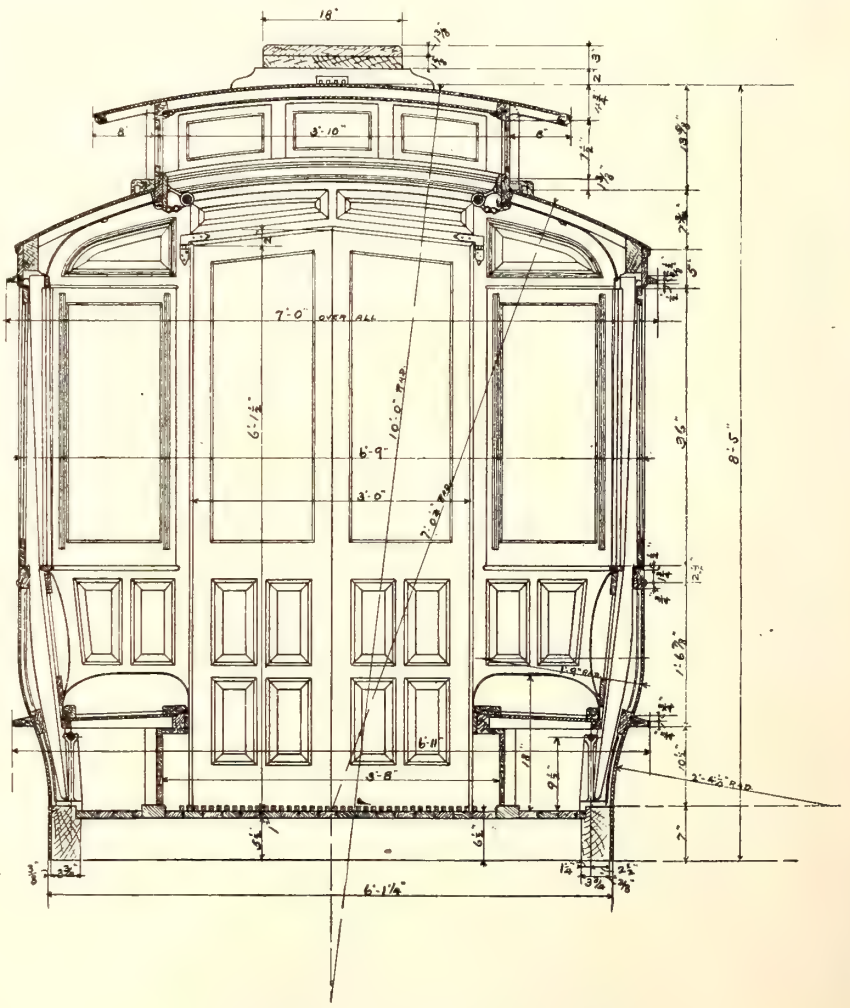
The Electric Railways of Havana

The city of Havana is located upon a peninsula and is very densely populated. The unhealthy condition of the city is, to a considerable extent, due to this dense population. There is a good chance for development of the suburbs in various directions, and as soon as a good system of rapid transit is provided these suburbs will grow rapidly. In the immediate vicinity of Havana are some very fine suburbs, particularly Carmelo and Vedado. This quarter is located upon the seashore a few miles from the city, and is now inhabited by the wealthier classes and by foreigners. It is now considered the healthiest location in the vicinity of Havana. Beyond this about 4 miles is a very fine beach, Maraino. The census of 1887 showed the population to be about 250,000. There was considerable increase since that date up to the time of the last war, when the population naturally fell off, and it is estimated that at present the population is about 275,000. It is estimated that the population in 1905 will be about 400,000. Up to the time of the organization of the Havana Electric Railway Company the street railway system, Ferro Carrill Urbano, consisted of about 25 miles of track located upon 13 miles of streets. Considering the size of the city, this amount of mileage was totally inadequate for the proper accommodation of the public, and, based on the experience in American cities, could be increased to three or four times the amount with advantage. The "Ferro" operated sixty-one cars and eleven steam engines. The number of passengers carried on the street railway lines before the war reached about 7,500,000 per year, even at the high rates of fare of 15 cents, 10 cents and 5 cents, which were charged on many of the lines. The Havana Electric Railway Company, which has taken over the property of the "Ferro" Company, has now in course of construction about 80 miles of track, and proposes to operate about 120 cars.

Before construction could be commenced it was necessary to submit to the Governor of Havana plans showing routes and details of construction, as well as specifications, plans and estimates for equipping the lines with electric motive power. The requirements of the Department of Havana were that the electrical system to be provided must be safe, rapid, elastic as to speed, comfortable, clean, convenient, flexible enough to serve all routes and sections of the city and suburbs, and cheap to operate and maintain. This would enable the dense population of Havana to spread out and live in a more healthful manner.

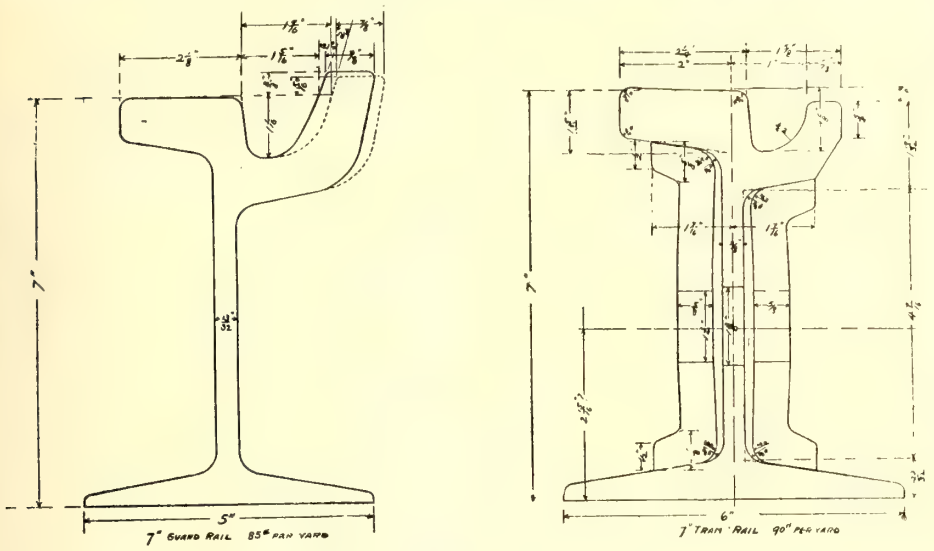
VIEW OF FERRY TO REGLA, OWNED BY THE CUBAN ELECTRIC CO.

Owing to the narrow streets in part of the city it was deemed proper to fix upon two maximum rates of speed on narrow streets, the average speed to be 6 miles per hour and maximum 8.5 miles per hour, and on wide streets the



SECTION OF STANDARD CAR, HAVANA

average speed to be 8.5 miles per hour and maximum 14 miles per hour. On each route cars will be run on a varying schedule to suit the requirements of travel, starting with ten-minute headway, reducing the headway to 7½ minutes and then to 5 minutes, so that during six hours daily the headway on each of the four lines will be 2½ minutes. Night-car service will be established from midnight until regular day-car service.



SECTIONS OF STANDARD RAILS

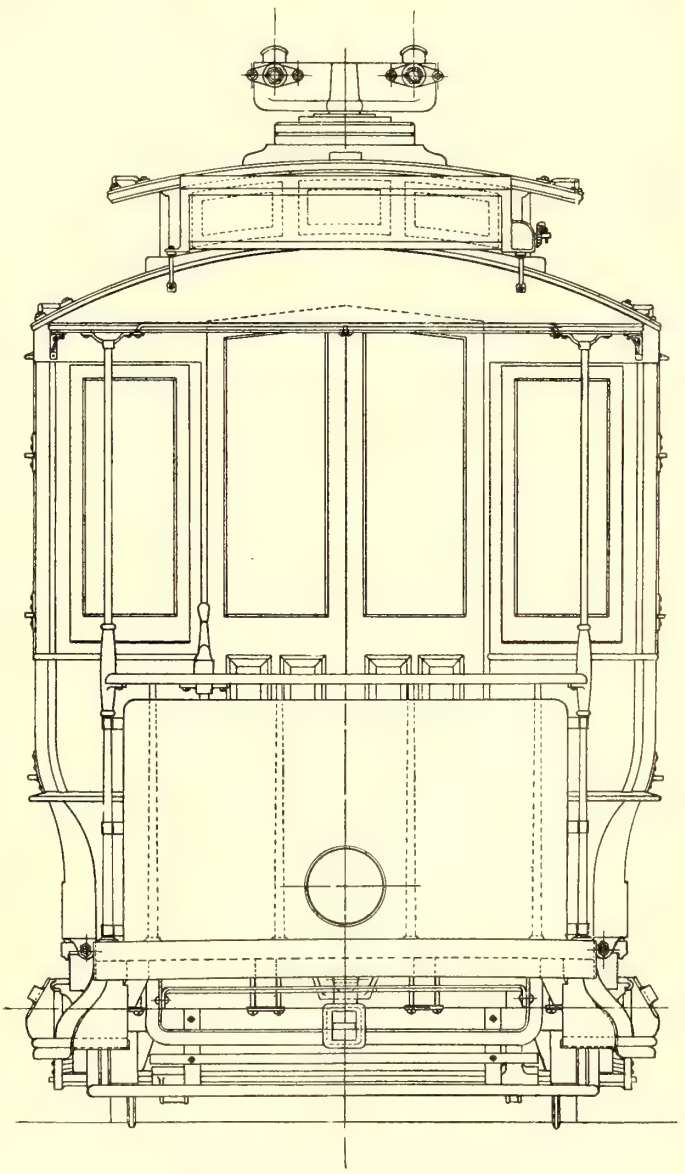
The cars, which are being made by the Jackson & Sharp Company, will have a seating capacity of twenty-six passengers and a maximum load of forty-five passengers. There are 120 of these cars, each being equipped with two Parmenter fenders. The cuts give a good idea of their construction.

The general dimensions of the car bodies are as follows: Length over all, 29 ft. 6½ ins.; length of body, 20 ft.; width of body over all, 7 ft.; height of body, 8 ft. 5 ins.; track gage, 4 ft. 8½ ins.; diameter of wheels, 30 ins.; wheel base, 7 ft.; type of truck, McGuire, A-1 suspension. Each motor car to be equipped with two General Electric 52 motors, capable of developing continuously for one hour 25 hp each without increasing the temperature of the motor windings more than 75 degs. C., and when so working to have not less than 77 per cent efficiency. If found necessary, freight cars will be placed on the lines to carry freight and express packages.

The track construction consists of 7-in. girder-rail, weighing 90 lbs. per yard, laid on concrete stringers, with standard soft steel ties 5 ft. 9 ins. in length and 7 ins. wide. The rail is fastened to the ties by clips or chairs, as shown in the illustration. The special track work will be of a design known as Adamantine construction. The rails, ties, etc., are being supplied by the Pennsylvania Steel Company. Between the rails and to a distance of 22 ins. outside the paving will consist of pyrogranite, asphalt and Macavoy brick. Beyond that limit the ordinary macadam will be used on the roadway.

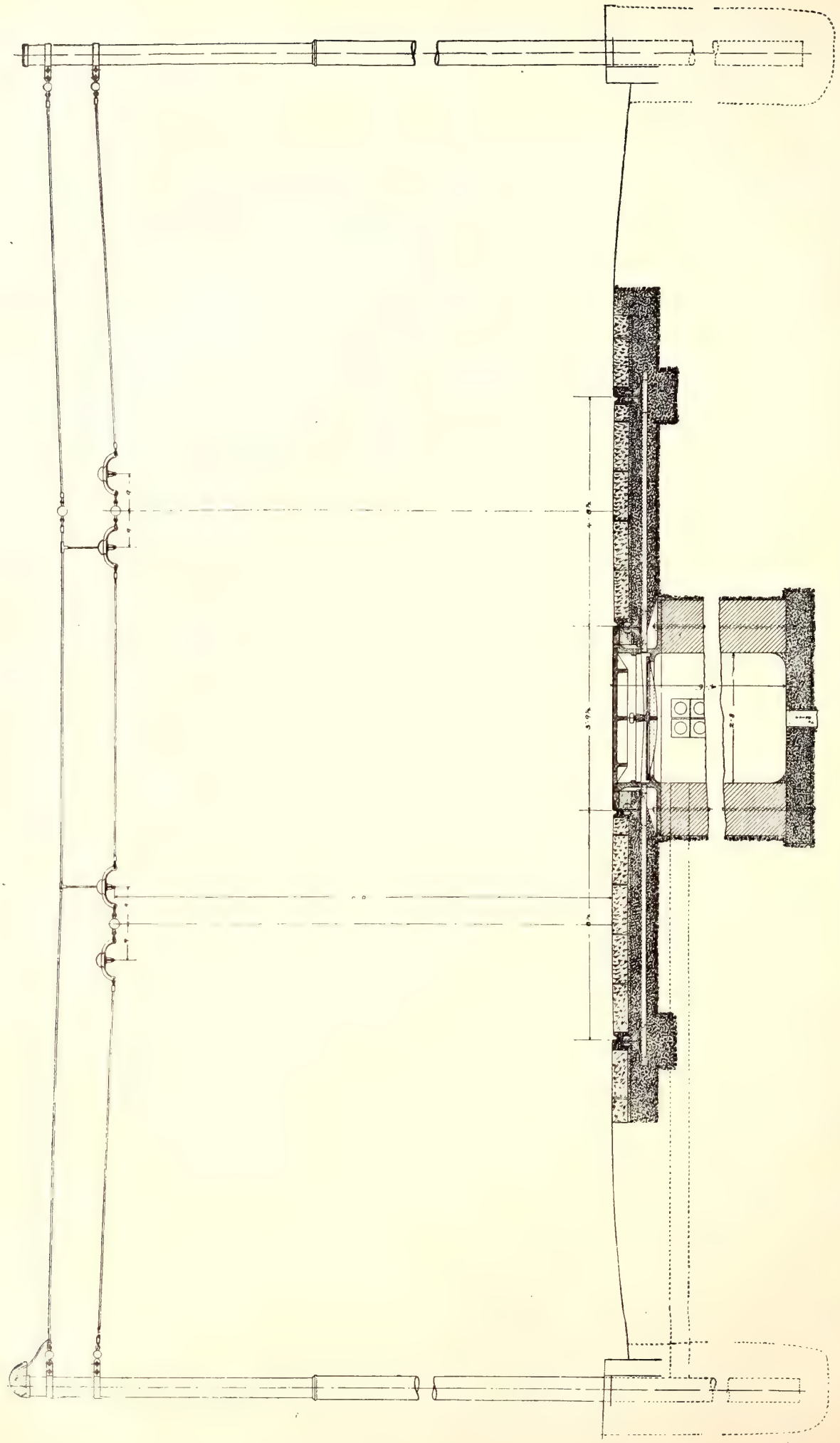
Most of the poles for the overhead construction are made of heavy iron pipe in two sections, the lower section being 6 ins. in diameter and the top section 5 ins. in diameter. The lower section is shrunk onto the top section, the poles when finished being 26 ft. over all. On narrow streets the overhead wire will be supported from hangers attached to the buildings, or the construction shown in the accompanying drawing will be used. All poles are to be set 6 ft. in the ground in concrete, the holes for receiving the poles being not less than 24 ins. in diameter. The span wire to be used is No. 7 galvanized iron wire. The Havana authorities have insisted that the double overhead trolley system be installed. The two trolley wires erected over each track, one for each side of the circuit, are 18 ins. center to center, the trolley wire being of hard drawn copper wire .325 ins. in diameter. The trolley wires are supported from the span wire by double curve insulators composed of a malleable iron body, screw cap and cone insulators and bronze ear, the ears being securely soldered to the trolley wire. The poles are being supplied by the Electric Railway Equipment Company, and the overhead material by the A. & J. M. Anderson Manufacturing Company. All feeder wires will be laid beneath the surface of roadway in ducts made of Potomac terra cotta. The feeders consist of 1,000,000-circ. mil and 500,000-circ. mil cables. All feeders were supplied by W. R. Brixey.

The power-station equipment consists of three vertical cross compound condensing engines with 48-in. stroke, high-pressure cylinder 23 ins. in diameter, low-pressure cylinder 60 ins. in diameter. The



END ELEVATION OF STANDARD CAR

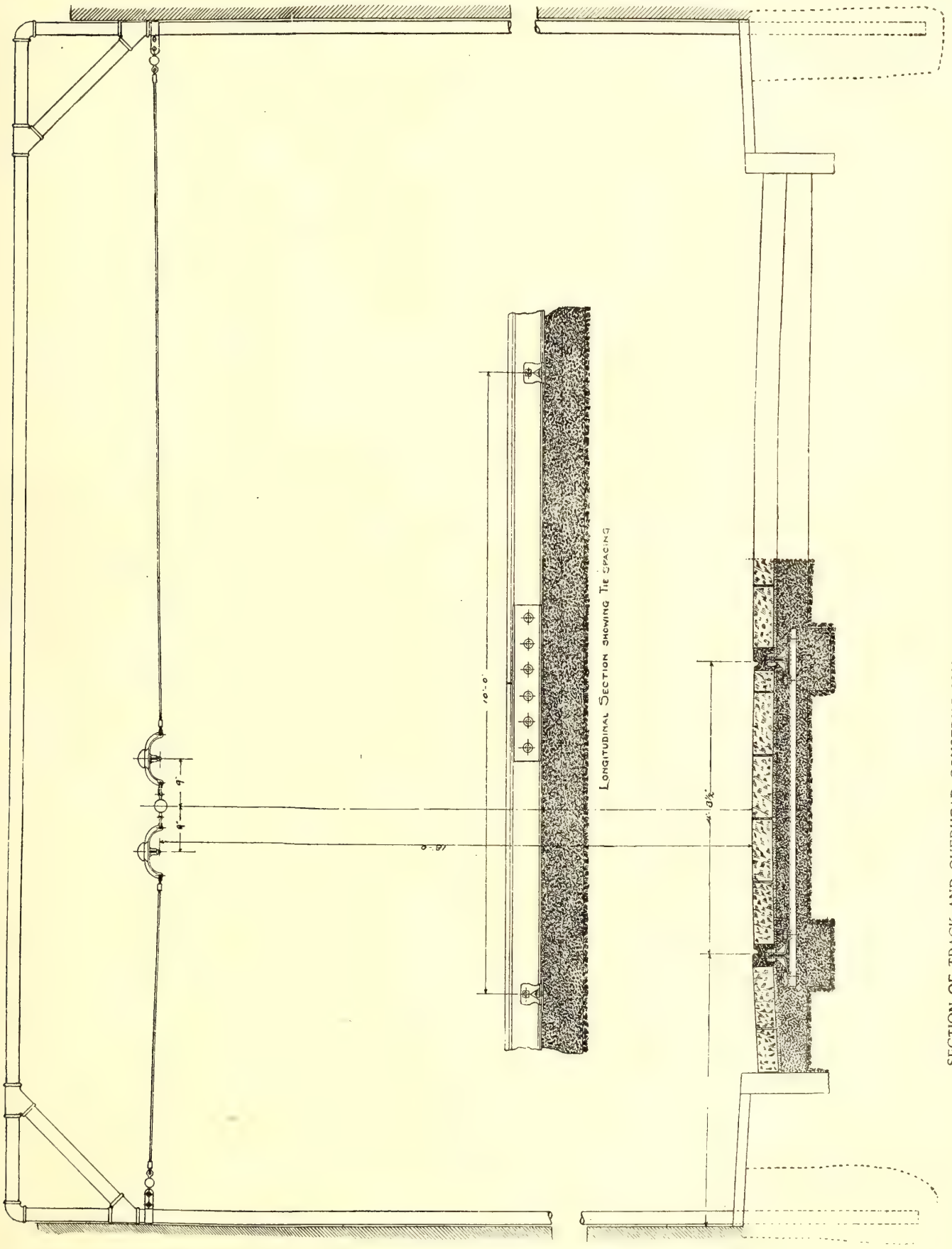
engines are of the E. P. Allis make, and are to be operated at 80 r. p. m., with 125 lbs. steam pressure. The



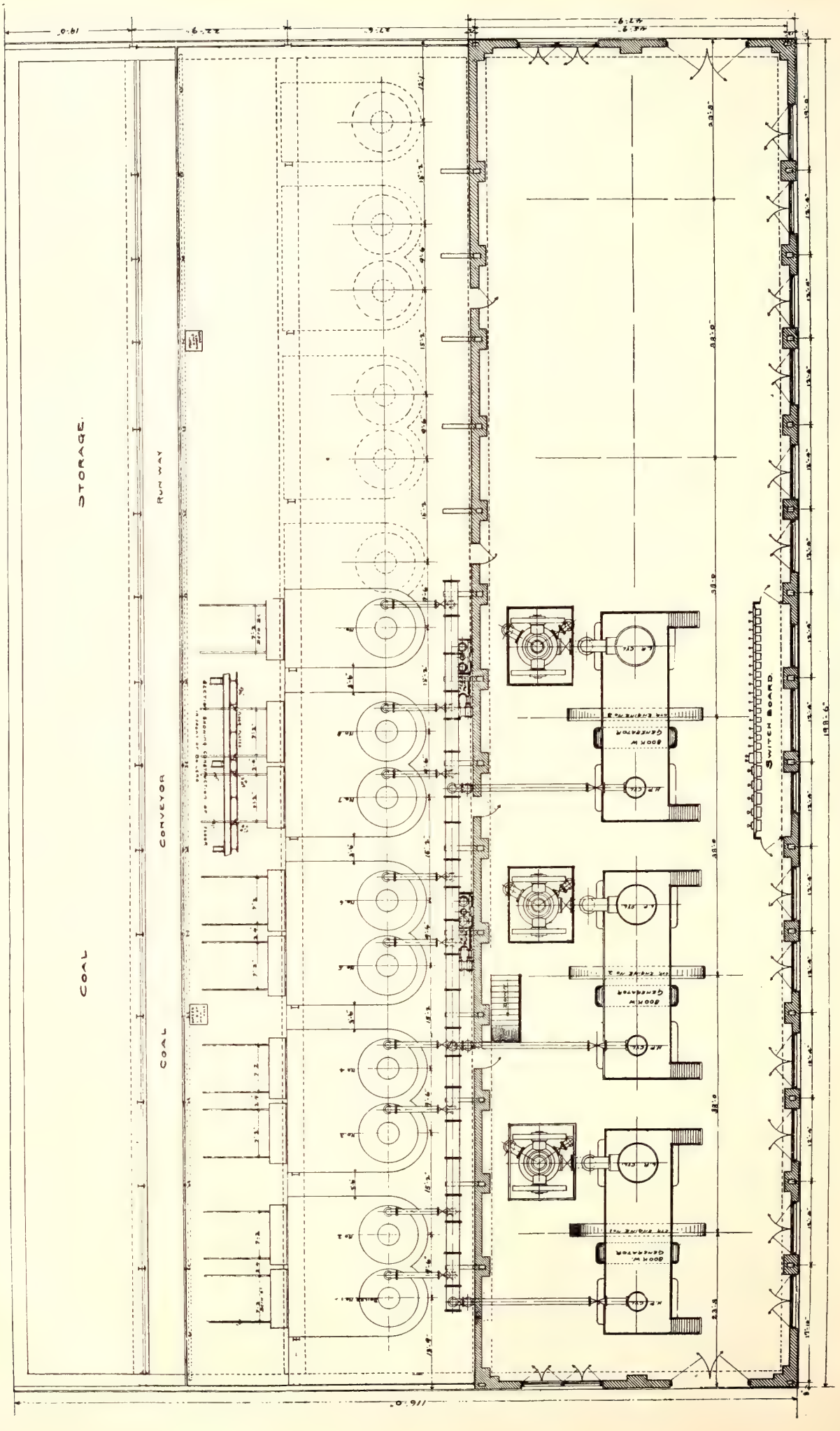
SECTION OF TRACK AND OVERHEAD CONSTRUCTION IN BROAD STREETS, SHOWING DOUBLE OVERHEAD WIRES AND UNDERGROUND FEEDER CONDUITS

boiler plant consists of nine vertical water-tube boilers of 250 hp each, set in three batteries. The boilers are of the Cahall vertical type.

The electrical equipment consists of three 850-kw generators of the General Electric Company's manufacture, voltage being 550, complete switchboards and accessories being furnished. A 50-kw Triumph dynamo is also included for lighting purposes. The power house building will be of steel construction, 198 ft. 6 ins. long by 96 ft. 6 ins. wide with a span in engine room of 45 ft. and a span over boilers of 51 ft. The walls of the building are to be of brick laid in lime mortar. The interior wall will be laid with enamel brick for a wainscot 6 ft. in height. The engine-room roof will be constructed of concrete laid on and between the steel purlins and covered with tile laid in cement. The roof over the boiler room is to be constructed of corrugated



SECTION OF TRACK AND OVERHEAD CONSTRUCTION IN NARROW STREETS, SHOWING OVERHEAD PIPE BRACE

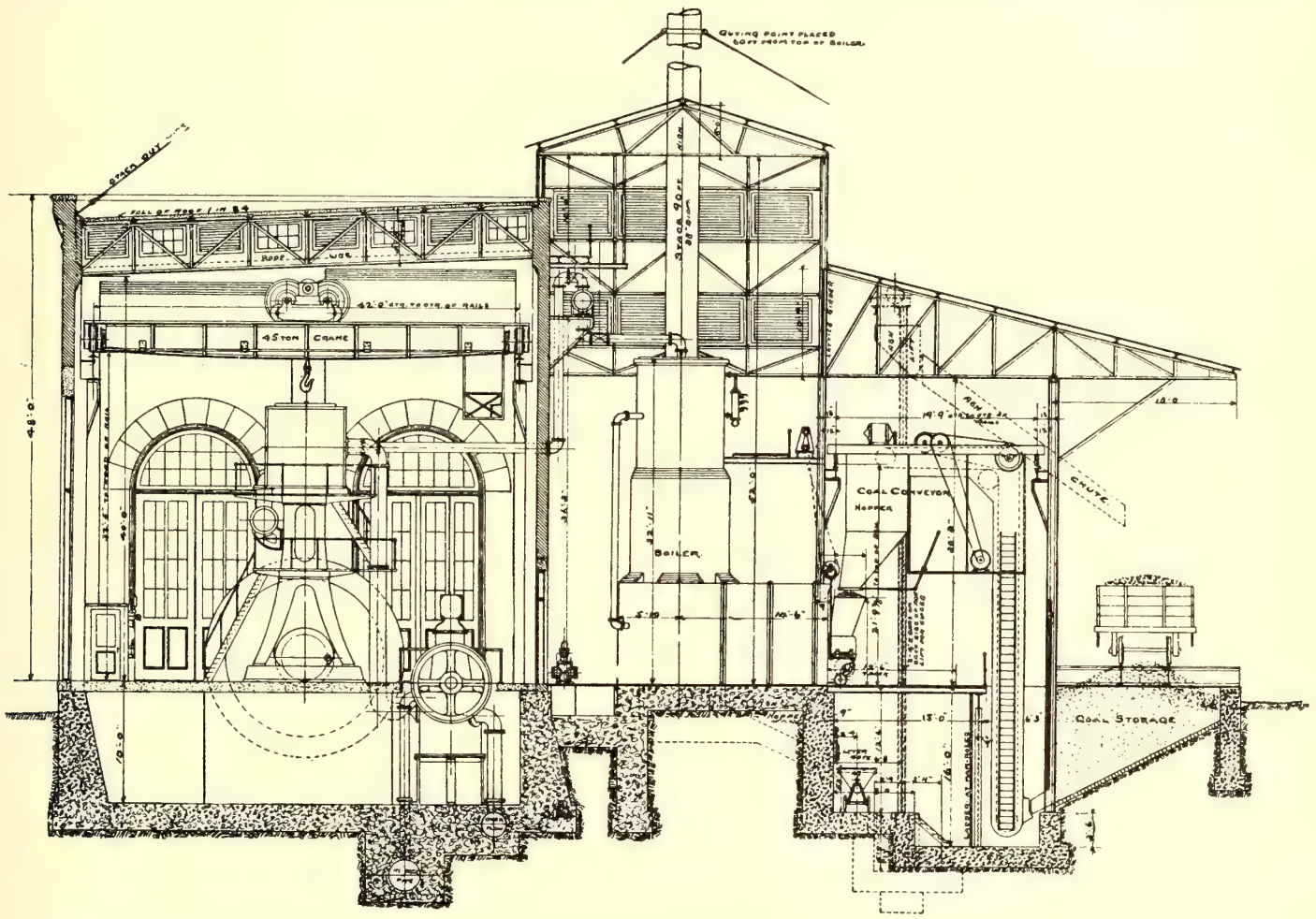


PLAN OF POWER STATION, HAVANA

iron securely fastened to the steel purlins. It is proposed to make the fare 5 cents, United States currency, anywhere in Havana. Transfer tickets will be given at intersecting points. The lines immediately within the city are expected to be in operation by Dec. 1, 1900. The Havana syndicate consists of Thomas F. Ryan, of New York; W. L. Elkins and P. A. B. Widener, of Philadelphia; A. Marcus, of New York, representing the French and English interests; Sir William Van Horne, Hanson Brothers, bankers; W. M. Doull and Frederic Nicholas, all of Montreal; William Mackenzie, of Toronto; A. H. Paget, Col. G. B. M. Harvey, F. S. Pearson, Percival Farquhar, of New York. G. F. Greenwood, formerly of Pittsburgh, is chief engineer and general manager. Owing to the many arduous conditions, the engineering work involved required unusual study and ability, and the successful results already shown are a tribute to Mr. Greenwood's skill and foresight.

Across the harbor from Havana and connected with it by ferry is the town of Regla. On March 10 last the first Cuban electric railway was opened, between this town and that of Guanabacoa, 4 miles inland. This line is part of the former Le Prueda Railroad Company's system, which was the first railway in Cuba to be operated by steam power, and is likewise the first to adopt electricity for its motive power. Originally, in 1858, the company was inaugurated for transit across the bay, and was known as the Primera Empresa de Vapores de la Bahia movidos porfuerza animal. Since then the town of Regla has developed into a suburb of 10,000 people, and the town of Guanabacoa has 20,000 inhabitants, and both contribute most of their working population to the main city of Havana, so as to require not only ample, but prompt, transit between the two points most of the day. With the electric cars and boats from the Lux wharf, this demand is now supplied in the most modern fashion.

The Cuban Electric Company bought the road on Jan. 16, 1899, and at once began the work of change of motive power. The company is organized under the laws of New Jersey with the following officers: President, Hon. A. F. Gault, of Montreal; directors, W. M. Doull and Wm. Hanson, Montreal; B. F. Pearson, Halifax, N. S.; F. S. Pearson and Col. G. B. M. Harvey, New York; general manager, A. C. Goudie. The company operates two ferry boats between the city of Havana and the town of Regla.



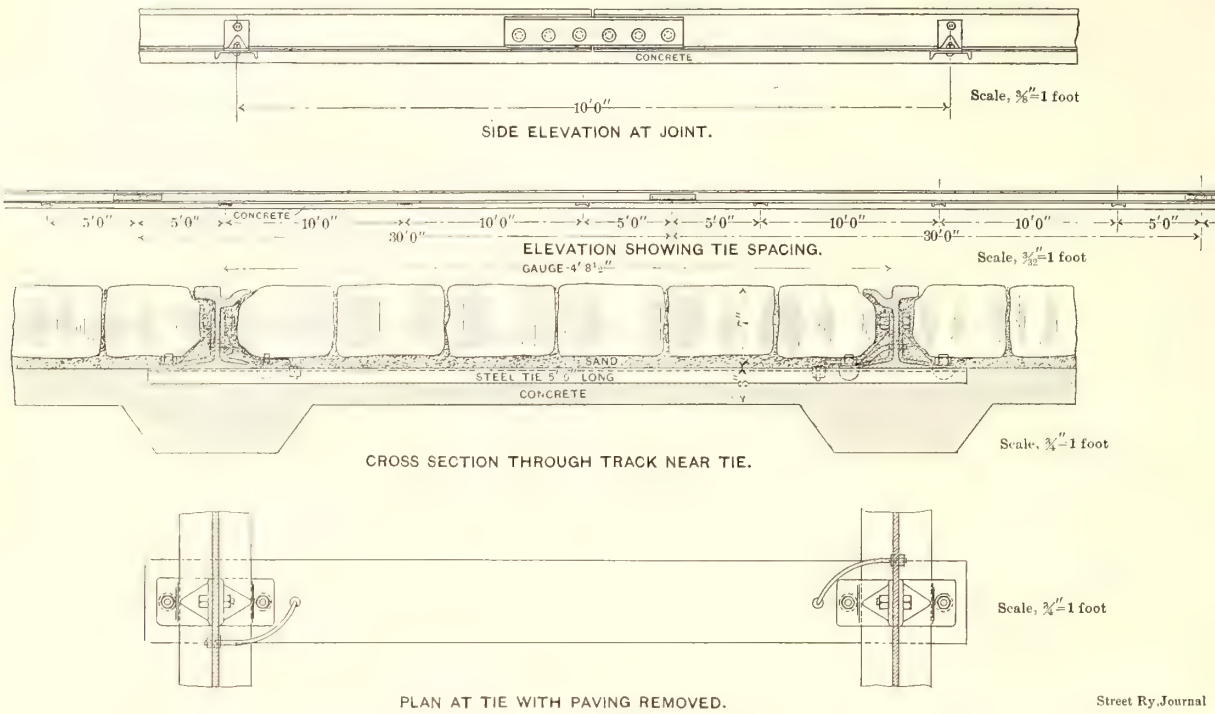
CROSS SECTION

SECTION OF POWER STATION, HAVANA

The trolley line begins at the ferry landing in Regla, and, after a winding course through the town and over private right of way, leads out into the open country through abandoned farm lands, where cool sea breezes greet the passengers. In the near future it is proposed to extend the line to the town of Cojimar, about 1 mile beyond Guanabacoa. In Guanabacoa the company is now constructing a pleasure park, where concerts and entertainments will be held and refreshments served. Later it is proposed to install an electric fountain. Besides the income from the transportation of passengers, the receipts from the passage of vehicles on the ferry line are considerable. Ample provision is made for their accommodation in the ferry houses. The present terminal at Regla is soon to be replaced by a modern steel frame building and proper facilities for handling the traffic. The electric cars are to run in between platforms which lead directly to the ticket booths and waiting rooms.

The track construction consists of both girder and T-rail.

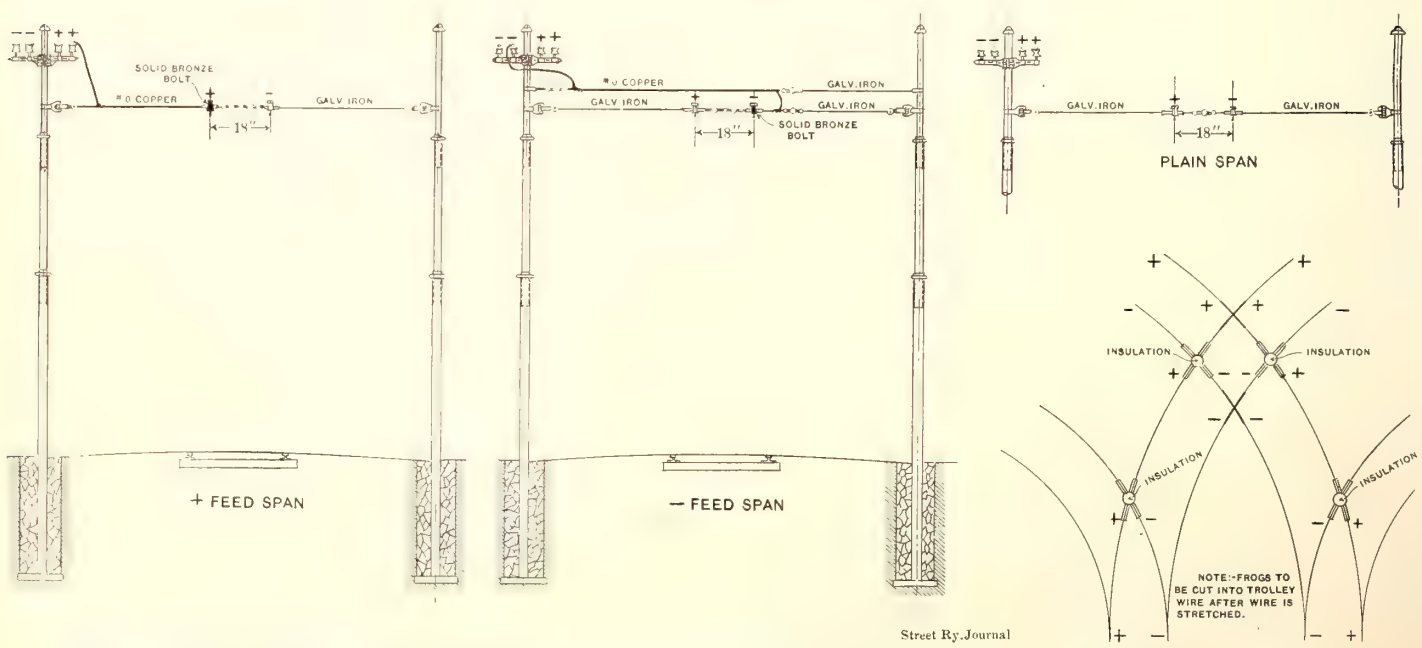
The girder-rail used is the Pennsylvania Steel Company's section No. 272, weighing 62 lbs. to the yard, and is laid on and securely bolted to steel cross-ties spaced 10 ft. apart on a longitudinal bed of concrete. The T-rail is of the Pennsylvania Steel Company's section No. 243, weighing wire. For a portion of the road the trolley wires are supported by single-pole brackets, but in general the span wire suspension is used. The maximum distance between poles is set at 125 ft. The feeders are of 500,000-circ. mil cable, and in Guanabacoa 00 grooved trolley wire is used. Light-



PLAN AND SECTION OF TRACK CONSTRUCTION, CUBAN ELECTRIC CO.

90 lbs. to the yard. The T-rails are laid on native hardwood ties 6 ft. x 6 ins. x 8 ins. spaced 2 ft. apart, on which they are securely spiked. The return circuit to the power station being by means of the trolley wire and overhead feeders, the track is not bonded. On account of local conditions the authorities, as in the city of Havana, com-

ning arresters for the protection of the line from lightning have been installed. The wire for the overhead construction was furnished by the American Steel & Wire Company, John A. Roebling Sons' Company and the General Electric Company. Line material, by the A. & J. M. Anderson Manufacturing Company.



VIEWS OF TROLLEY SPANS WITH PLUS AND MINUS FEEDER CONNECTIONS, AND PLAN OF DOUBLE TRACK Y, SHOWING LOCATION OF INSULATORS

pelled the company to install a double overhead trolley system. The construction is much like that described above, except that overhead feeders are used. The illustrations show the peculiar precautions which must be taken with the double trolley construction at turnouts and where the positive or negative feeder is connected to its respective

The rolling stock consists of four 28-ft. vestibuled cars of the J. G. Brill Company's make, mounted on Eureka maximum traction trucks. The old cars of the company are used as trailers. The seats of the new cars are upholstered in cane and arranged transversely with an aisle through the center, having a seating capacity of forty pas-

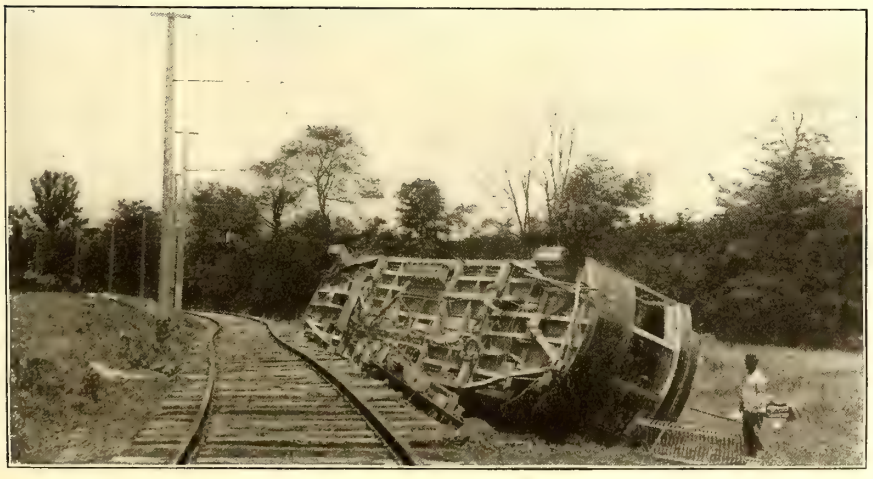
sengers. The cars are equipped with the West End type of fender. The motor equipment consists of two Westinghouse No. 38-B, 50-hp motors.

The power-station equipment consists of two horizontal tandem compound condensing side-crank engines made by the Robb Engineering Company, Amherst, N. S., directly connected to two Westinghouse 150-kw generators, the voltage at full load being 550 volts. The entire electric equipment of the power station was furnished by the Westinghouse Company. The steam, exhaust and water piping, with valves and fittings, were furnished by the Robb Engineering Company. The boiler equipment consists of one battery, 400 hp, of Cahall vertical boilers furnished through Thayer & Company. The power-station building is of steel construction, and was furnished by the Ritter-Conley Company. Two iron tanks are used, having a capacity of 10,000 gals., for the purpose of supplying the water for condensing purposes, these tanks being connected to the roofs of the buildings by drips, so as to catch the rainwater.

STANDARD 28-FT. MOTOR CAR, CUBAN ELECTRIC CO.

An Accident on the Cincinnati, Lawrenceburg & Aurora Street Railway

The accompanying illustration shows an accident which took place on July 4 on the Cincinnati, Lawrenceburg & Aurora Street Railway, caused by the breaking of a flange on the outside front wheel of the rear truck. The piece of the flange broken out was 12½ ins. long, and was broken off at a point 3 miles from where the accident occurred.



ACCIDENT NEAR AURORA

The car was running 20 miles per hour on a 1000-ft. curve, when it left the rails. The motorman applied the brakes, and stopped the car after it ran 150 ft. on the ties. The car had come to a stop before it turned over, and although there were thirty-four people aboard no one was seriously hurt, except a boy who jumped from the rear platform just as the car turned over; he was caught under the corner post and killed.

The irregular bend in the track, as shown in the engraving, was caused by throwing over the track after the accident occurred, in order to clear the line. The car itself was but slightly injured.

The accompanying illustration was furnished by J. B. Crankshaw, engineer of the road.

Street Car Building

(Stephenson Practice.)

BY CHARLES HENRY DAVIS, C. E.

VII.—Assembling—(Continued)

In the July issue of the STREET RAILWAY JOURNAL we gave the details of the bodies for our two standard cars, namely, the Boston (closed) and the Brooklyn (open). Tables Nos. 35 and 36 give respectively the details of roofs for the standard cars, while Plates VII. and VIII. illustrate the various parts. As in tables Nos. 31, 32, 33 and 34, each distinct part of the roof is described, giving the material, the general dimensions, how made, on what tools and how assembled, all in consecutive order as each car is built in the shop. In using these tables they are to be read across the page, line by line, as in the case of any book. In Column 1 the numerals indicate, in consecutive order, the number of distinctive pieces; where a letter follows the numeral it indicates another operation, but not another distinctive piece. Letters in Column 4 are the same abbreviations of wood work and metal work as used on Plates I. and II. These tables are given on the following pages.

TABLE NO. 35

DETAIL OF ROOFS AND BONNETS OF BOSTON CLOSED CAR, IN THE ORDER OF ASSEMBLING

(25 ft. Body; Car No. 2; Fig. 3; Plates I. and VII.)

Consecutive Number	Quantity	Name of Piece	Piece Number Plates I. and VII.	Material See Plates I. and II.	Details: Quantity	Details: Name	Reference Letter Plate VII.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									During the erection of the sides and ends of the body (*see Table No. 33 and Plate V.*), the assembling of the pieces composing the framework of the "Moniter" roof has been proceeded with independently as follows:—	
104	2	**Ventilator plain-bottom-rails** (Figs. 197, 198)	2002	A.	..	.....	..	25 ft. 0 in. x 4½ in. x 1⅝ in.	Each having:—	
					2	Mortises		1¼ in. x ½ in. x 4 in	Not seen, one at each end, for ventilator side-corner-posts (2003) to tenon into, with two holes for dowel-pins	Hollow chisel mortiser
					8	Mortises	a	1⅝ in. x 1¼ in. x ½ in.	For ventilator side-posts (2005) to tenon into, with holes for dowel-pins	Hollow chisel mortiser
					8	Double Mortises	b	⅝ in. x ¾ in. x ½ in.	For rafters for lower-deck compound-carlines (2016) to tenon into	Hollow chisel mortiser
					27	Mortises	c	1⅛ in. x ¾ in. x ½ in.	For lower-deck rafters to tenon into (2015)	Hollow chisel mortiser
					1	Rabbet	d	full length x ⅞ in. x ⅜ in.	For ventilator side-sash (4001) to rest on	Molding machine
					1	Rabbet	e	full length x 1 in. x ⅝ in.	For roofing-boards (2014) and ventilator bottom-rail roof-molding (2027) to fit in	Molding machine
					2	Rabbets	f	full length x ½ in. x ⅛ in.	To fit the ventilator bottom-rail facia (4104)	Molding machine
									These rails are laid on horses, being prepared as above, and the following pieces are adjusted to them:—	
105	4	**Ventilator side-corner-posts** (Fig. 210)	2003	A.	..	.....	..	10⅛ in. x 4 in. x 1⅝ in.	Each having:	
					1	Tenon	a	4 in. x 1¼ in. x ½ in.	Tenoned into the end mortises of ventilator plain-bottom-rail (2002), glued and secured with two hickory dowel-pins each	End tenoner
					1	Tenon	b	4 in. x 1 in. x ½ in.	To tenon into end mortises (a) of ventilator top-rail (2001), Fig. 199	End tenoner
					2	Holes	c		For No. 14 x 2½ in. screws to secure the ventilator end-corner-posts (2004), Figs. 211, 212	Borer
					1	Bead	d		For inside ornament	Molding machine
106	16	**Ventilator side-posts** (Fig. 213)	2005	A.	..	.....	..	10⅛ in. x 1⅝ in. x 1¼ in.	Each having:—	
					1	Tenon	a	1¼ in. x ½ in.	Tenoned into mortises (a) of ventilator plain-bottom-rail (2002), glued and secured with hickory dowel-pins	End tenoner
					1	Tenon	b	1 in. x ½ in.	To tenon into mortises (f) of ventilator top-rail (2001), Fig. 199	End tenoner
					1	Bead	c		For inside ornament	Molding machine
					2	Ogees	d		For inside ornament	Chamfering machine
107	2	**Ventilator top-rails** (Fig. 199)	2001	Y. P.	..	.....	..	24 ft. 11¼ in. x 3 in. x 1⅝ in.	Each having:—	
					2	Mortises	a	4 in. x 1 in. x ⅝ in.	For ventilator side-corner-post tenons (b) to fit into; they are glued and secured with 4 No. 10 x ¾ in. steel screws	Hollow chisel mortiser
					2	Tenons	b	1 in. x 1 in.	To fit in rabbets (b) of the upper-deck head-rafters (2006), Fig. 205	End tenoner
					8	Gains	c	1½ in. x 1¼ in.	For upper-deck compound-carlines (2008), Fig. 196, to fit in	Multiple gainer
					27	Gains	d	1⅛ in. x 1¼ in.	For upper-deck rafters (2007), Fig. 217, to fit in	Multiple gainer
					1	Ogee	e		For inside ornament	Chamfering machine
					8	Mortises	f	1 in. x ½ in.	On under side, not seen, for ventilator side-post tenons (b) to fit into; they are glued and secured with 16 No. 10 x 1¼ in. steel screws	Hollow chisel mortiser
108	4	**Ventilator end-corner-posts** (Figs. 211, 212)	2004	A.	..	.....	..	10½ in. x 2⅜ in. x 1⅝ in.	Each having:—	
					1	Tenon	a	2 in. x 1¼ in. x ⅝ in.	To fit in rabbet (c) of the end top-rail (1006), Fig. 108, Plate V.	End tenoner
					1	Tenon	b	2⅜ in. x 1 in. x ½ in.	To fit in mortise (a) of the upper-deck head-rafter (2006), Fig. 205. They are also further secured to the ventilator side-corner-posts with 8 No. 14 x 2½ in. steel screws	End tenoner
					1	Rabbet	c	¾ in. x ⅜ in.	For ventilator end-sash (4007) to fit in	Molding machine
109	2	**Upper-deck head-rafters** (Figs. 204, 205)	2006	A.	..	.....	..	5 ft. 9¼ in. x 2 15-16 x 1⅝ in.	Each having:—	
					2	Mortises	a	2⅜ in. x 1 in. x ½ in.	For tenons (b) of the ventilator end-corner-posts to fit into; they are glued and secured with hickory dowel-pins	Hollow chisel mortiser
					2	Rabbets	b	1⅝ in. x 1 in. x 1 in.	For tenons (b) of the ventilator top-rails (2001) to fit in; they are secured with 4 No. 14 x 3½ in. steel screws	Car gainer
					2	Tenons	c	1¼ in. x ½ in. x 1¾ in.	To fit in mortises (a) of the ventilator eaves-rail (2009), Fig. 200	End tenoner
					1	Rabbet	d	¾ in. x ⅝ in.	For ventilator end-sash (4007) to fit in	Shaper
110	8	**Upper-deck compound-carlines** (Fig. 196)	2008	....	..	.....	..	5 ft. 9¼ in. x 1½ in. x 1¼ in.	They being composed of:—	
111	16	**Upper-deck rafters** (Fig. 218)	2007	A.	..	.....	..	5 ft. 9¼ in. x ½ in. x 1¼ in.	In pairs, each having:—	
					2	Tenons	a	1¼ in. x ½ in. x ½ in.	To fit into mortises (c) of the ventilator eaves-rail (2009), Fig. 200	End tenoner
					2	Ogees	b		On one side and at each end of the rafters. These rafters are bolted with 48 bolts 2 in. x ¼ in., round heads, one to each side of the top part (A) of	Chamfering machine
111a	8	**Steel-carlines** (Fig. 206)	2501	W. S.	..	.....	..	9 ft. 11 in. x 1⅛ in. x ½ in.	Each having:—	
					6	Holes	a	5-16 in. diam.	For bolts to secure upper-deck rafters	Drill press
					6	Holes	b	5-16 in. diam.	For bolts to secure lower-deck rafters (2015), Fig. 216. (*See Con. No. 117*)	Drill press
					2	Feet	c	1 in. long	With 7-16 in. hole through them for bolting to side top-rail. The compound carlines are now fixed in the gains (c) of the ventilator top-rails (2001), Fig. 199, and secured with 32 No. 10 x 2 in. steel screws	
112	27	**Upper-deck rafters** (Fig. 217)	2007	A.	..	.....	..	5 ft. 9¼ in. x 1⅛ in. x 1¼ in.	Each having:—	
					2	Tenons	a	1¼ in x 1⅛ in. x ½ in.	To fit into mortises (b) of the ventilator eaves-rail (2009), Fig. 200. These rafters are now fixed in the gains (d) of the ventilator top-rails (2001) and secured with 54 No. 10 x 2 in. steel screws	End tenoner
					4	Ogees	b		One on each side at and each end of the rafters, for ornament	Chamfering machine
113	2	**Ventilator eaves-rails** (Fig. 200)	2009	A.	..	.....	..	About 25 ft. 8 in. x 1¼ x 1¼"	Each having:—	
					2	Mortises	a	1⅜ in. x ½ in.	For tenons (c) of upper-deck head-rafters to fit into	Hollow chisel mortiser
					27	Mortises	b	1⅛ in. x ½ in.	For tenons (a) of upper-deck rafters to fit in	Hollow chisel mortiser
					8	Double mortises	c	½ in. x ½ in.	For tenons (a) of the upper-deck compound-carline rafters (2007) to fit into. (*See Con. No. 111*)	Hollow chisel mortiser
					2	Splice-bevels	d	4 in. long	For splicing to ventilator-hood bow (2011), Fig. 219. Sometimes the mortises into which the upper-deck head-rafters tenon into are in the bow, as shown in Fig. 219, in which case the eaves-rails would be about 24 ft. 7½ in. long. The eaves-rails are fitted to the upper-deck rafter tenons and draw-pinned with 74 hickory dowel-pins	Usually sawed and fitted by hand
114	2	**Ventilator-hood bows** (Fig. 219)	2011	R. E.	..	.....	..	7 ft. to 8 ft. 2 in. x 1¼" x 1¼"	Bent to shape and having:—	
					2	Mortises	a	1⅜ in. x ½ in.	For tenons (c) of upper-deck head-rafters (2006) to fit into	Hollow chisel mortiser
					2	Splice-bevels	b	4 in. long	For splicing to ventilator eaves-rail (2009), Fig. 200; the bows are fitted to the upper-deck head-rafter tenons (c) and draw-pinned with 4 hickory dowel-pins, and also secured to the eaves-rails with 16 No. 10 x 1 in. steel screws	Usually sawed and fitted by hand

115	16	**Compound-carline filling-in pieces** (Not Ill.)	2017	A.	--	----------	--	7 in. x 1¼ in. x ½ in.	Glued between the rafters of the compound-carlines where they project beyond the ventilator top-rails	Band saw
116	16	**Lower-deck compound-carlines** (Fig. 196)	2016	----	--	----------	--	1 ft. 9⅜ in. x 2⅜ in. x 1½ in.	They being composed of :—	Band saw and shaper
117	32	**Lower-deck rafters** (Fig. 216)	2015	A.	--	----------	--	1 in. 9⅜ in. x 2⅜ in. x ½ in.	Each having :—	Band saw and shaper
					1	Tenon	a	¾ in. x ½ in. x ½ in.	To fit in mortises (b) of the ventilator plain-bottom-rails (2002), Fig. 197, to which they are secured with 32 No. 10 x 1 in. steel screws	End tenoner
					1	Gain	b	3¼ in. x 1 in.	To interlock with gains (c) of the side top-rails (1005), Fig. 93, Plate V., and *Con. No. 55, Table No. 33.* These rafters are bolted with 48 bolts 2 in. x ¼ in., round heads, one to each side of the lower projecting piece (B) of the steel carlines described *Con. No. 111*	End tenoner
117a	54	**Lower-deck rafters** (Fig. 215)	2015	A.	--	----------	--	1 ft. 9⅜ in. x 2⅜ in. x 1⅛ in.	Each having :—	
					1	Tenon	a	1⅛ in. x ¾ in. x ½ in.	To fit in mortises (c) of the ventilator plain-bottom-rails (2002), Fig. 197, to which they are secured with 54 No. 10 x 1 in. steel screws	End tenoner
					1	Gain	b	3¼ in. x 1 in.	To interlock with gains (a) of the side top-rails (1005), Fig. 93, Plate V., and *Con. No. 55, Table No. 33.* The skeleton frame-work of the roof as it now appears is shown very clearly in Fig. 196, the lower-deck rafters at the back being omitted, so as to show more clearly the general construction	End tenoner
118	2	**Roofing-boards** (Fig. 208)	2014	P.	--	----------	--	26 ft. 6 in. x 13 in. x ⅜ in.	Beaded on the under side to represent single strips are now laid in white-lead lengthwise over the projecting portion of the upper-deck rafters next the eaves-rails, and are secured to the rafters with 222 No. 10 x 1¼ in. steel screws, and to the ventilator top-rails, eaves-rails and hood-bows with 160 No. 10 x 1¼ in. steel screws ; the intervening space between these two boards is then filled up with	Flooring machine
118a	15	**Roofing-boards** (Fig. 209)	2014	P.	--	----------	--	26 ft. 6 in. x 3 in. x ⅜ in.	Beaded on one edge, nailed to the upper-deck rafters and ventilator hood-bows with clout-nails	Flooring machine
119	68	**Upper-deck furring-pieces** (Fig. 224)	2021	A.	--	----------	--	6¾ in. x 2⅜ in. x 1¼ in.	And	
	4	**Upper-deck furring-pieces** (Fig. 225)	2021	A.	--	----------	--	9½ in. x 2⅜ in. x 1¼ in.	Screwed to the roofing-boards between the upper-deck rafters, and alongside the ventilator top-rail with 76 No. 10 x 1¼ in. steel screws The roof is now ready to be attached to the car body, in the condition we left it in at the end of Table No. 33, the order of procedure being	
119b	--	**Steel-carlines** (Fig. 206)	2501	----	--	----------	--		See *Con. No. 111*, are bolted through the holes in the feet (c) to the side top-rails with 16 bolts, 3¾ in. x ⅜ in.	
119c	--	**Lower-deck rafters** (Figs. 215, 216)	2015 2016	----	--	----------	--		See *Con. No. 117*, nave their gains (b) well varnished, interlocked with gains (a and c) of the side top-rails, and screwed to the latter with 86 No. 12 x 1½ in. steel screws	
120	2	**Side-roof joint-breakers** (Not Ill.)	2025	A.	--	----------	--	25 ft. 0¾ in. x 1½ in. x ½ in.	Are nailed to the outside of the side top-rails (1005) above the rabbet (b) for the letter-board. (*See Fig. 93, Plate V. and Con. No. 55, Table No. 33*)	
120a	--	**Ventilator plain-bottom-rails** (Figs. 197, 198)	2002	----	--	----------	--		Are adjusted to notches (b), Fig. 109, Plate V., of the end top-rail (1006) and screwed to it with 4 No. 16 x 3 in. steel screws	
120b	--	**Ventilator end-corner posts** (Figs. 211, 212)	2004	----	--	----------	--		Are adjusted to rabbets (c), Fig. 108, Plate V., of the end top-rail (1006) and screwed to it with 4 No. 12 x 1½ in. steel screws	
120c	2	**Roofing-boards** (Fig. 208)	2014	P.	--	----------	--	25 ft. 0 in. x 14 in. x ½ in.	Are laid in white-lead, and screwed to the lower-deck rafters and side top-rails with 144 No. 10 x 1¼ in. steel screws, their lower edges forming the eaves of the lower-deck. The remaining space up to the ventilator plain-bottom-rails is filled with	
20d	6	**Roofing-boards** (Fig. 209)	2014	P.	--	----------	--	25 ft. 0 in. x 3 in. x ½ in.	Nailed to the lower-deck rafters, fit in the rabbets (e) of the ventilator plain-bottom-rails and screwed to the end top-rails with 12 No. 10 x 1¼ in. steel screws	
121	2	**Upper-deck end-furring pieces** (Fig. 230)	2023	A.	--	----------	--	3 ft. 6⅝ in. x 2½ in. x 1¼ in.	Screwed to the upper-deck roofing-boards close up against the end top-rails with 10 No. 10 x 1¼ in. steel screws	
122	72	**Lower-deck furring-pieces** (Fig. 223)	2024	A.	--	----------	--	6¾ in. x 1¾ in. x 1¼ in.	Screwed to the lower-deck roofing-boards centrally between the rafters with 72 No. 10 x 1¼ in. steel screws	
123	1	**White duck** (Not Ill.)	2020	----	--	----------	--	8 ounce	Is now laid all over the upper-deck roof in thick paste, composed of whiting mixed with linseed oil and japan, carefully stretched and tacked all round to the sides of the ventilator eaves-rails and hood-bows, after which	
124	4	**Ventilator hood-bow lead-moldings** (Fig. 221)	2503	----	--	----------	--	¾ in. half-round	Are nailed over the duck to the sides of the corners of the hood-bows	
125	2	**Ventilator eaves-moldings** (Fig. 203)	2010	A.	--	----------	--	¾ in. half-round	Are nailed over the duck to the sides of ventilator eaves-rails	Molding machine
126	2	**Ventilator hood-bow moldings** (Not Ill.)	2012	P.	--	----------	--	¾ in. half-round	Same as Fig. 203, nailed over the duck to the sides of the hood-bows in continuation of the lead moldings at the corners	Molding machine
126a	1	**White duck** (Not Ill.)	2020	----	--	----------	--	8 ounce	Is laid over the two lower-deck roofs in similar manner to the upper-deck, and tacked to the side-roof joint-breakers (2025), and further secured by	
127	2	**Ventilator bottom-rail roof-moldings** (Fig. 201)	2027	P.	--	----------	--	25 ft. 0 in. x 2¾ in. x ⅜ in.	Inserted in the rabbet (e) of the ventilator plain-bottom-rail (2002), Fig. 197, and nailed to the roof	Molding machine
128	2	**Lower-deck eaves-moldings** (Fig. 207)	2026	A.	--	----------	--	¾ in. half-round	Are nailed over the duck to the sides of the side-roof joint-breakers, after which the roofs receive three coats of white-lead all over the duck	Molding machine
									The preparation of the outside of the car body previous to painting and finishing is now proceeded with as follows :—1st and 2d days—One coat of permanent wood priming, consisting of oil and white-lead laid all over. 3d and 4th days—Two coats of lead priming (white-lead with a little oil). 5th day—Fill all holes and depressions with putty. 6th day—Scrape soft putty in open grains and give first coat of roughstuff. 7th and 8th days—Second and third coats of roughstuff. 9th day—Rub the roughstuff with pumice stone and water to bring to a smooth surface. The cars are now externally in what is termed "the white," ready to receive later their coats of color, as shown in Fig. 107, Plate V.	
									The under surfaces of the roofing-boards receive a coat of boiled oil	
									The top side of the flooring receives two coats of boiled oil	
									It is usual at this stage to attach the platforms to the body, but as their description includes a number of accessories related to "traction" they will be dealt with in a separate table, and	
129	--	**Platform-hoods** (Figs. 226, 227)	2029	----	--	----------	--		(Often called bonnets) will now be taken up. They are made independently whilst the construction of the body as described is in progress, and consist of :—	
129a	2	**Platform-hood bows** (Fig. 228)	2032	R. E.	--	----------	--	2 in. x 1⅜ in.	Steamed and bent to shape on a form, each having :—	
					2	Gains	a		For platform-hood shoulder-carline (2030), Fig. 231	Gainer
					6	Gains	b		For platform-hood rafters (2031), Fig. 232	Gainer
					1	Chamfer	c		For ornament, seen in Fig. 226	Chamfering machine
130	2	**Platform-hood shoulder-carlines** (Fig. 231)	2030	A.	--	----------	--	1 7-16 in. x 1¼ in.	Steamed and bent to shape on a form, each having :—	
					2	Gains	a		To interlock with gains (a) of the platform-hood bows, to which they are screwed with 4 No. 12 x 1 in. steel screws.	End tenoner
					1	Chamfer	b		For ornament	Chamfering machine
131	6	**Platform-hood rafters** (Fig. 232)	2031	A.	--	----------	--	1¼ in. x 1 in.	Steamed and bent to shape on a form, each having :—	
					2	Gains	a		To interlock with gains (b) of the platform-hood bows, to which they are screwed with 12 No. 10 x 1 in. and 12 No. 10 x ¾ in. steel screws	End tenoner
					2	Chamfers	b		For ornament, seen in Fig. 226	Chamfering machine
131a	33	**Roofing-boards** (Fig. 226)	2014	P.	--	----------	--	3 in. x 5-16 in.	Beaded and nailed to platform-hood bows, shoulder-carlines and rafters	Flooring machine
131b	1	**White duck** (Not Ill.)	2020	----	--	----------	--	8 ounce	Is now laid and stretched over the roof in soft white-lead paint, tacked to the bows and further secured by	
132	2	**Platform-hood iron-moldings** (Not Ill.)	2506	W. I.	--	----------	--	¾ in. half-round	Screwed to the bows with 54 No. 12 x 1¼ in. steel screws. The duck is then given three successive coats of white-lead, and when dry the platform-hoods are attached to the car body with 18 No. 16 x 2½ in. round-headed steel screws and washers screwed through the shoulder-carlines into the end top-rails. Further security is given by	
133	4	**Platform-hood brackets** (Fig. 238)	2507	M. I.	--	----------	--		Screwed to the corner-posts and platform-hoods with 36 No. 12 x 1¼ in. steel screws	

TABLE No. 35—*Continued*

Consecutive Number	Quantity	Name of Piece	Piece Number Plates I. and VII.	Material See Plates I and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate VII	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
134	2	**Platform-hood shoulder-carline moldings** (Fig. 229)	2034	P.	..	.....	..	½ in. quarter-round	Nailed to the end top-rails and the top of the platform-hood, the ends joining the ventilator bottom-rail roof-molding (2027) on each side of the ventilator. (*See Con. No. 126*)	Molding machine
135	4	**Platform-hood joint-straps** (Fig. 233)	2505	W. I.	..	.....	..	20 in. x 1¾ in. x ⅛ in.	Are screwed over the joining of the platform-hood roof to the lower-deck roof, with 36 No. 10 x 1¼ in. steel screws	
136	2	**Platform-hood watersheds** (Fig. 230)	2052	A.		.....	..	1 ft. 10 in. x ½ in. x ½ in.	Screwed to the top front of the platform-hood with 14 No. 4 x 1 in. and 4 No. 4 x 1¼ in. steel screws	
137	16	**Steel-carline covers** (Fig. 214)	2502	Tin	..	.....	..		Nailed to ventilator side-posts and bottom-rail roof moldings	
138	2	**Trolley cord guards** (Fig. 222)	2508	W. I.	..	.....	..		Screwed to under side of platform-hood bows (2032) with 8 No. 14 x 1½ in. steel screws	
139	..	**One trolley-bridge**	....	....	..	.....	..		Is independently put together, and then attached to the roof. It consists of	
139a	2	**Trolley-board long-rails** (Fig. 244)	2035	A.	..	.....	..	8 ft. 0 in. x 3 in. x 1¾ in.	These are bolted to	Planer and shaper
140	4	**Trolley-board short-rails** (Fig. 245)	2036	A.	..	.....	..	4 ft. 2½ in. x 2½ in. x 2 in.	With 8 bolts 4 x 5-16 in. The frame formed by these rails is placed on the roof in the center of the car, the long rails lying exactly over the ventilator side top-rails, bedded in soft white-lead and screwed to the upper-deck roof with 12 No. 20 x 4 in. steel screws	Planer and shaper
141	2	**Trolley-boards** (Fig. 243)	2037	A.	..	.....	..	8 ft. 0 in. x 6 in. x 2 in.	Are then screwed side-by-side to the center of the trolley-board short-rails (2036) with 16 No. 10 x 3½ in. steel screws. In the center of these are four bolt holes, 9-16 in. diam. for 4 x ½ in. bolts, whose heads are let in flush on the underside and covered with leather to prevent their falling out; they serve to hold the trolley-base in place	Planer
142	..	**Two upper-deck landings** (Fig. 239)	2038	A.	..	.....	..		Are now secured to the upper-deck roof at each end, meeting the trolley-boards in the center; they are composed of	
142a	4	**Upper-deck landing-battens** (Fig. 237)	2041	A.	..	.....	..	3 ft. 4½ in. x 2 in. x ⅝ in.	Curved to the arc of the roof, and	Band saw and shaper
142b	6	**Upper-deck landing-battens** (Fig. 236)	2041	A.	..	.....	..	1 ft. 3¼ in. x 2 in. x ⅝ in.	To which are secured	Band saw and shaper
143	6	**Upper-deck landing-slats** (Fig. 234)	2039	A.	..	.....	..	8 ft. 7½ in. x 3 in. x ⅝ in.	And	Planer
143a	10	**Upper-deck landing-slats** (Fig. 235)	2039	A.	..	.....	..	2 ft. 6½ in. x 3 in. x ⅝ in.	With 100 No. 10 x 1¼ steel screws. The battens being laid in soft white-lead, the landings are then screwed to the roof with 42 No. 12 x 2 in. and 42 No. 12 x 1½ in. steel screws	Planer
144	..	**Two lower-deck landings** (Fig. 241)	2043	A.	..	.....	..		Are now screwed to diagonally opposite corners of the lower-deck roof, being composed of	
144a	4	**Lower-deck landing-battens** (Fig. 240)	2045	A.	..	.....	..	1 ft. 1 in. x 1½ in. x ⅝ in.	To which are screwed	Planer
145	10	**Lower-deck landing-slats** (Fig. 242)	2044	A.	..	.....	..	2 ft. 5½ in. x 1½ in. x ⅝ in.	With 40 No. 10 x 1¼ in. steel screws. The battens are laid in soft white-lead and the landings screwed to the roof with 4 No. 12 x 2 in. and 4 No. 12 x 1½ in. steel screws	Molding machine
									These cars have in some cases six direction signs, and in others eight, on the roofs and bonnets covering five different varieties which will now be described	
146	2	**Lower-deck sign-boards, 1 side** (Fig. 246)	2046	P.	..	.....	..	15 ft. 6 in. x 5 in. x ¾ in.	Ornamental ends, one on each side of the car, with 3 holes on under side to fit on the sign-board pins (2510), Fig. 254	Planer and chamfering machine
147	6	**Sign-board washers** (Fig. 263)	2511	M. I.	..	.....	..		Screwed to under side of the boards with 12 No. 12 x 1½ in. steel screws, to protect the holes for the pins named above, Con. No. 146	
148	6	**Sign-board pins** (Fig. 254)	2510	M. I.	..	.....	..		Screwed to the sides of the lower-deck roof with 18 No. 12 x 1½ in. steel screws	
149	..	**Lower-deck box-signs**	....	....	..	.....	..		Are used in some cases, one on each side on the lower deck roof; they are four-sided, and consist of	
149a	8	**Sign-box boards** (Fig. 247)	2047	D.	..	.....	..	8 ft. 4 in. x 4¾ in. x ½ in.	With ornamental ends, fitted together in box-form, by being bolted to	Planer and chamfering machine
150	4	**Sign-box pivots** (Fig. 251)	2512	M. I.	..	.....	..		With 32 carriage bolts 1 x ¼ in. In the center of the boxes and to stiffen them	
151	2	**Sign-box blocks** (Fig. 260)	2051	A.	..	.....	..	4¾ in. x 4¾ in. x 1 in.	Are inserted and screwed to the sign-boards with 16 No. 12 x 1¼ in. steel screws	
152	4	**Sign-box brackets** (Fig. 250)	2513	M. I.	..	.....	..		To receive the pivots, are screwed to the sides of the lower deck roof with 20 No. 12 x 1¼ in. round-headed steel screws. To keep the boxes in their brackets	
153	4	**Sign-box pivot-washers** (Fig. 261)	2521	M. I.	..	.....	..		Are slipped over the projecting stud of the pivot and secured with	
154	4	**Sign box pivot-cotters** (Not Ill.)	2522	W. S.	..	.....	..		Passed through the holes at the ends of the studs	
155	2	**Upper-deck end sign-boards, 1 side** (Fig. 256)	2048	P.	..	.....	..	4 ft. 4½ in. x 5 in. x ¾ in.	With ornamental ends, one at each end of the monitor roof, with 2 holes on under side to fit on the sign-board pins (2514), Fig. 255	Band saw and shaper
156	4	**Sign-board washers** (Fig. 264)	2515	M. I.	..	.....	..		Screwed to under side of above boards with 8 No. 12 x 1½ in. steel screws, to protect the pin-holes in the boards	
157	4	**Sign-board pins** (Fig. 255)	2514	M. I.	..	.....	..		Screwed to the ends of the upper-deck roof with 8 No. 12 x 1½ in. steel screws	
158	2	**Upper-deck sign-boards, 2 sides** (Fig. 248)	2049	P.	..	.....	..	7 ft. 2 in. x 5 in. x ¾ in.	With round ends, one at each side of the car on the upper-deck, secured to	Planer
159	4	**Sign-board pivots** (Fig. 258)	2516	M. I.	..	.....	..		With 16 No. 12 x ¾ in. steel screws	
160	4	**Sign-board brackets** (Fig. 253)	2517	M. I.	..	.....	..		To receive the pivots are screwed to the sides of the upper-deck roof with 12 No. 12 x 1¼ in. round-headed screws; they are held in place with	
160a	4	**Sign-board pivot-washers** (Fig. 261)	2521	M. I.	..	.....	..		Same as Con. No. 152, and	
160b	4	**Sign-board pivot-cotters** (Not Ill.)	2522	W. S.	..	.....	..		Same as Con. No. 153	
161	4	**Sign-board guards** (Not Ill.)	2523	W. I.	..	.....	..	3½ in. half-round	Same as (2506) No. 132, are screwed to each side of the sign-boards with 56 No. 12 x 1½ in. steel screws	
162	..	**Bonnet box-signs** (Not Ill.)	....	....	..	.....	..		Two in number, consisting of	
162a	8	**Sign-box boards** (Fig. 257)	2050	P.	..	.....	..	3 ft. 7¼ in. x 5 in. x ½ in.	With ornamental ends fitted together in box-form by being bolted to	Planer and chamfering machine
163	4	**Sign-box pivots** (Fig. 252)	2518	M. I.	..	.....	..		And	
164	4	**Sign-box frames** (Fig. 259)	2520	M. I.	..	.....	..		With 48 carriage bolts 1 x ¼ in.	
165	4	**Sign-box brackets** (Fig. 249)	2519	M. I.	..	.....	..		To receive the pivots are bolted and screwed to the platform-hoods with 12 round-headed stove-bolts 1 x ¼ in. and 4 No. 12 x 1¼ in. round-headed steel screws	
165a	4	**Sign-box pivot-washers** (Fig. 261)	2521	M. I.	..	.....	..		Same as Con. No. 152, and	
165b	4	**Sign-box pivot-cotters** (Not Ill.)	2522	W. S.	..	.....	..		Same as Con. No. 153	
									Before putting these signs together the boards are primed all over with lead containing oil, then the backs receive two coats of white-lead. After the box signs are fitted to the pivots they, as well as the single sign-boards, are treated as follows:—1st day—All holes and depressions filled with putty. 2d day—Scrape soft putty in open grains, etc. 3d day—Ground coat of white-lead tinted with color. 4th day—First coat of color. 5th day—Second coat of color with varnish to make a gloss. 6th day—Apply the letters as required. 7th and 8th days—Two coats of railway coach finishing varnish. The colors are various, some of the signs being buff, some vermilion and some white. The platforms and accessories will be treated of next. *See Con. No. 166, Table No. 37 and Plates I. and IX.*	

Number of Distinctive Pieces.... 62 (Column 1)
Total Number of Pieces..... 622 (" 2)
Number of Bolts..... 216 (" 6 and 10)
Number of Screws (about).....1622 (" 6 and 10)
Number of Nails..... ?
Total.....2460 +

TABLE NO. 36

DETAIL OF ROOFS AND BONNETS OF BROOKLYN OPEN CAR, IN THE ORDER OF ASSEMBLING

(12 Benches; Car No. 4; Fig. 5; Plates II. and VIII.)

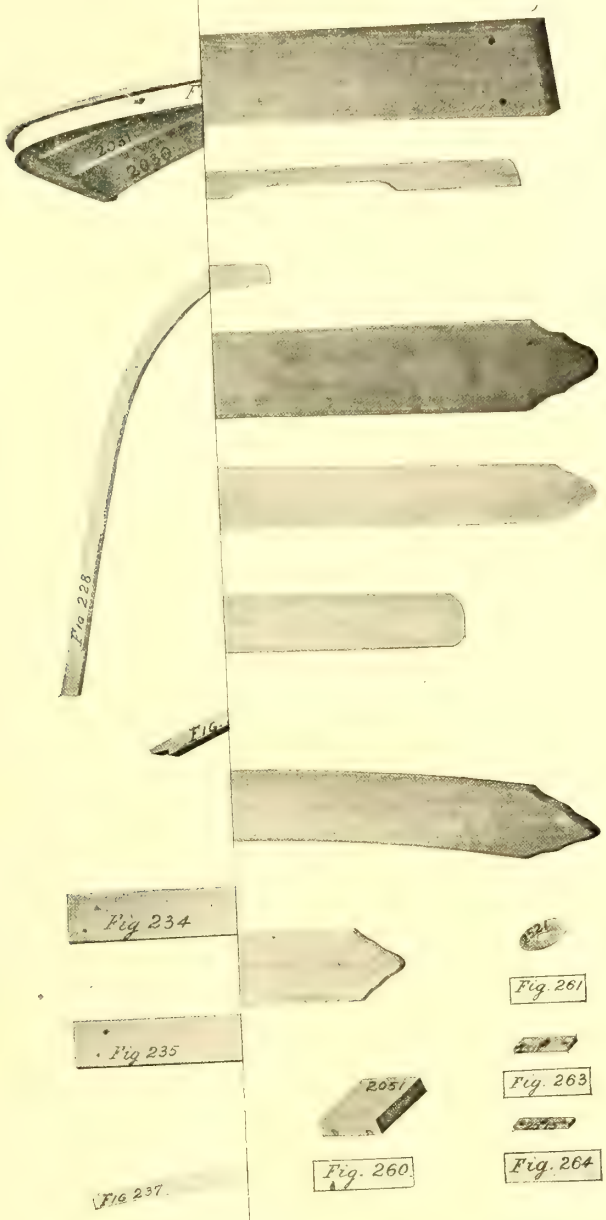
Consecutive Number	Quantity	Name of Piece	Piece Number Plates II. and VIII.	Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate VIII.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									During the erection of the sides and ends of the body (see Table No. 34 and Plate VI.) the assembling of the pieces composing the framework of the "Monitor" roof has been proceeded with in a similar manner to that of the closed car, as described in Table No. 35	
66	2	**Ventilator plain bottom-rail** (Fig. 266)	7021	Y. P.	--	----------	--	26 ft. 3¼ in. x 2¾ in. x 1½ in.	Each having:—	
					2	Mortises	--	3 in. x 1 in. x ½ in.	Not seen, one at each end, for ventilator side-corner-posts (7003), Fig. 272, to tenon into, with two holes for dowel-pins	Hollow chisel mortiser
					10	Mortises	--	1⅞ in. x 1 in. x ½ in.	Not seen, for ventilator side-posts (7005) to tenon into, with holes for dowel-pins	Hollow chisel mortiser
					2	Mortises	a	1⅞ in. x ¾ in. x ½ in.	For lower-deck thick-rafters (7011) to tenon into	Hollow chisel mortiser
					18	Mortises	b	13-16 in. x ¾ in. x ½ in.	For lower-deck thin-rafters (7012) to tenon into	Hollow chisel mortiser
					8	Double mortises	c	13-16 in. x ¾ in. x ½ in.	For lower-deck rafters for compound-carlines (7013) to tenon into	Hollow chisel mortiser
					1	Groove	d	Full length x ⅜ in. x ⅜ in.	For roofing-boards (7016) to fit in	Molding machine
67	4	**Ventilator side-corner-posts** (Fig. 272)	7003	A.	--	----------	--	10⅝ in. x 3⅝ in. x 1½ in.	Each having:	
					1	Double tenon	a	3 in. x 1 in. x ½ in.	Tenoned into end mortises of ventilator bottom rail (7021), glued and secured with two hickory dowel-pins	Double end tenoner
					1	Tenon	b	1¼ in. x 1 in. x ½ in.	To tenon into end mortises of ventilator top-rail (7001), Fig. 265	Double end tenoner
68	20	**Ventilator side-posts** (Fig. 275)	7005	A.	--	----------	--	10⅝ in. x 1⅞ in. x 1½ in.	Each having:—	
					1	Tenon	a	1⅞ in. x 1 in. x ½ in.	Tenoned into mortises of ventilator bottom-rail (7021) and secured with hickory dowel-pins	Double end tenoner
					1	Tenon	b	1⅞ in. x 1 in. x ½ in.	To tenon into mortises (e) of ventilator top-rail (7001)	Double end tenoner
69	2	**Ventilator top-rails** (Fig. 265)	7001	Y. P.	--	----------	--	26 ft. 1¾ in. x 2½ in. x 1½ in.	Each having:—	
					2	Tenons	a	1½ in. x 1 in. x ¾ in.	To tenon into mortise in upper-deck head-rafter (7007), Fig. 267	End tenoner
					2	Mortises	--	1¼ in. x 1 in. x ½ in.	Not seen, one at each end on the underside for ventilator side-corner-posts to tenon-into, with hole for dowel-pin	Holllow chisel mortiser
					2	Gains	b	1⅞ in. x 1⅜ in.	For upper-deck thick-rafters (7008) to fit in	Multiple gainer
					18	Gains	c	13-16 in. x 1⅜ in.	For upper-deck thin-rafters (7009) to fit in	Multiple gainer
					8	Gains	d	1⅞ in. x 1⅜ in.	For upper-deck compound-carlines (7010) to fit in	Multiple gainer
					10	Mortises	e	1⅞ in. x 1 in. x ½ in.	To receive tenons (b) of the ventilator side-posts (7005)	Hollow chisel mortiser
70	4	**Ventilator end-corner-posts** (Fig. 273)	7004	A.	--	----------	--	11 3-16 in. x 2½ in. x 1¾ in.	Each having:—	
					1	Tenon	a	2 in. x 1⅞ in. x ½ in.	To fit in mortise (e) of the end top-rail (6006), Figs. 150 to 152, Plate VI. (*See Con. No. 31, Table No. 34*)	Double end tenoner
					1	Tenon	b	2¼ in. x 1¾ in. x ½ in.	To fit in mortise (b) of the ventilator upper-deck head-rafter (7007), Fig. 267	Double end tenoner
					1	Rabbet	c	½ in. x 5-16 in.	For ventilator end-sign-sash to fit in. The end-corner-posts are also secured to the side-corner-posts with 8 No. 14 x 2½ in. steel screws	Molding machine
71	2	**Upper-deck head-rafters** (Fig. 267)	7007	A.	--	----------	--	5 ft. 6½ in. x 2¼ in. x 1¾ in.	Each having:	
					2	Tenons	a	1¾ in. x ¾ in. x ½ in.	To fit in mortises in the ventilator eaves-rail (7014)	Double end tenoner
					2	Mortises	b	2¼ in. x 1¾ in. x ½ in.	On the underside to receive the tenons (b) of the end-corner-posts, the same being glued and secured with dowel-pins	Hollow chisel mortiser
					2	Rabbets	--	1½ in. x 1 in. x ¾ in.	On the other side, to receive the tenons (a) of the ventilator top-rails, Fig. 265 (7001), they are secured with 4 No. 14 x 3½ in. steel screws	Multiple gainer
					2	Mortises	c	2 in. x 1¼ in. x ½ in.	On the underside to receive the tenons (b) of the ventilator end-center-posts (7006), Fig. 276	Hollow chisel mortiser
					2	Rabbets	d	½ in. x 5-16 in.	For ventilator end-sign-sash to fit in	Shaper
72	2	**Upper-deck thick-rafters** (Fig. 268)	7008	A.	--	----------	--	5 ft. 6½ in. x 1⅞ x 1 5-16 in.	Each having:	
					2	Tenons	a	1⅞ in. x ¾ in. x ½ in.	To fit in mortises in the ventilator eaves-rail (7014), to which they are secured with dowel-pins	Double end tenoners
					2	Gains	b	1½ in. x ½ in. x ⅛ in.	To interlock with gains (b) of the ventilator top-rail (7001), to which they are secured with 4 No. 10 x 2 in. steel screws	Multiple gainer
					4	Chamfers	c		For ornament	Shaper
73	18	**Upper-deck thin-rafters** (Fig. 270)	7009	A.	--	----------	--	5 ft. 6½ in. x 13-16 x 1 5-16 in.	Each having:	
					2	Tenons	a	13-16 in. x ¾ in. x ½ in.	To fit in mortises in the ventilator eaves-rail (7014), to which they are secured with dowel-pins	Double end tenoner
					2	Gains	b	1½ in. x ½ in. x ⅛ in.	To interlock with gains (c) of the ventilator top-rail (7001), to which they are secured with 36 No. 10 x 2 in. steel screws	Multiple gainer
					4	Chamfers	c		For ornament	Shaper
74	--	**Upper-deck compound-carlines** (Fig. 271)	7010	----	--	----------	--		Composed of	
74a	16	**Upper-deck thin-rafters** (Fig. 269)	7009	A.	--	----------	--	5 ft. 6½ in. x 13-16 x 1 5-16 in.	In pairs, same as Con. No. 73, but with the chamfer (c) on one side only; these rafters are bolted with 32 bolts, 2¼ in. x ¼ in., round heads, one to each side of the top part of	
75	8	**Steel carlines** (Fig. 271)	7501	W. S.	--	----------	--	1¼ in. x 5-16 in.	Each having:	
					4	Holes	a	5-16 in. diam.	On the top for bolts to secure upper-deck rafters	Power punch
					6	Holes	b	5-16 in. diam.	In the side projections for bolts to secure the lower-deck rafters	Power punch
									The compound-carlines are now fitted in the gains (d) of the ventilator top-rails (7001) and secured with 32 No. 10 x 2 in. steel screws	
76	2	**Ventilator eaves-rails** (Not Ill.)	7014	Y. P.	--	----------	--	27 ft. 7¾ in. x 1½ in. x 1¼ in	Each having:—	
					2	Tenons	--	1½ in. x ¾ in. x ½ in.	One at each end, to fit into mortises (a) of the ventilator-hood bow (7015), Fig. 279	End tenoner
					2	Mortises	--	1¾ in. x ¾ in. x ½ in.	To receive the tenons (a) of the upper-deck head-rafters	Hollow chisel mortiser
					2	Mortises	--	1⅞ in. x ¾ in. x ½ in.	To receive the tenons (a) of the upper-deck thick-rafters	Hollow chisel mortiser
					9	Mortises	--	13-16 in. x ¾ in. x ½ in.	To receive the tenons (a) of the upper-deck thin-rafters	Hollow chisel mortiser
					8	Double mortises	--	13-16 in. x ¾ in. x ½ in.	To receive the tenons (a) of the upper-deck compound-carlines. The eaves-rails are fitted to the various upper-deck rafters, and draw-pinned with hickory dowel-pins	Hollow chisel mortiser
77	2	**Ventilator hood-bows** (Fig. 279)	7015	A.	--	----------	--	5 ft. 8 in. x 1 5-16 in. x 1 in.	Each having:	
					2	Mortises	a	1½ in. x ¾ in. x ½ in.	To receive the end tenons of the ventilator eaves-rails, which are secured with dowel-pins	Hollow chisel mortiser
78	16	**Compound-carline filling-in pieces** (Fig. 287)	7028	A.	--	----------	--	7⅜ in. x 1¾ in. x ¼ in.	Glued between the rafters of the compound-carlines where they project beyond the ventilator top-rails	
79	4	**Lower-deck thick-rafters** (Fig. 278)	7011	A.	--	----------	--	20 in. x 1⅞ in. x 1 5-16 in.	Each having:	
					1	Tenon	a	1⅞ in. x ¾ in. x ½ in.	To fit in mortises (a) of the ventilator bottom-rail	End tenoner
					1	Gain	b	2¼ in. x 7-16 in.	To fit the gains (c) of the side top-rails (6018), Fig. 163, Plate VI.	Band saw

TABLE No. 36—*Continued*

Consecutive Number	Quantity	Name of Piece	Piece Number Plates II. and VIII.	Material See Plates I. and II.	Details: Quantity	Details: Name	Reference Letter Plate VIII.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
80	36	**Lower-deck thin-rafters** (Fig. 277)	7012	A.	--	----------	--	20 in. x 13 16 in. x 1 5-16 in.	Each having:	
					1	Tenon	a	13-16 in. x ¾ in. x 1⅝ in.	To fit in mortises (b) of the ventilator bottom-rail	
81	--	**Lower-deck compound-carlines**	7013	----	1	Gain	b	2¼ in. x 7-16 in.	To fit the gains (d) of the side top-rails (6018), Fig. 163, Plate VI.	End tenoner
81a	32	**Lower-deck thin-rafters** (Fig. 277)	7012	A.	--	----------	--	20 in. x 13-16 in. x 1 5-16 in.	Composed of	Band saw
									In pairs same as Con. No. 80; these rafters are bolted with 48 bolts, 2¼ in. x ¼ in., round heads, one to each side of the lower projecting pieces of the steel-carlines described, Con. No. 74, and shown in Fig. 271, and fit in gains (b) of the side top-rails (6018), Fig. 163, Plate VI.	
82	2	**Ventilator end-center-posts** (Fig. 276)	7006	A.	--	----------	--	10 9-16 in. x 2 in. x 1¾ in.	Each having:—	
					1	Tenon	a	1½ in. x 2 in. x ½ in.	To fit mortise (d) of the end top-rail (6006), Figs. 150 to 152, Plate VI.	Double end tenoner
					1	Tenon	b	2 in. x 1¼ in. x ½ in.	To fit in mortise (c) of the upper-deck head-rafter (7007), Fig. 267, both of which are secured with wood dowel-pins	Double end tenoner
83	20	**Roofing-boards** (Not Ill.)	7016	P.	--	----------	--	3½ in. wide, ⅜ in. thick	Nailed to the upper-deck rafters, hood-bows and eaves-rails with clout-nails. The roof is now ready to be attached to the car body, in the condition in which it was at the end of Table No. 34	Tongued and grooved and beaded on flooring machine
83a	--	**Lower-deck rafters**	----	----	--	----------	--		See Con. Nos. 79, 80, 81 have their gains (b) fitted to the gains of the side top-rails, and are screwed to them with 72 No. 12 x 1½ in. steel screws	
83b	--	**Ventilator end-corner** and **end-center-posts**	----	----	--	----------	--		Are tenoned into mortises (e) and (d) in the end top-rail, Figs. 150 to 152, Plate VI., and secured with dowel-pins	
83c	--	**Ventilator bottom-rails**	----	----	--	----------	--		Are tenoned and pinned to the end top-rails	
83d	12	**Roofing-boards** (Not Ill.)	7016	P.	--	----------	--	3½ in. wide, ⅜ in. thick	Nailed to the lower-deck rafters and end top-rails	
84	2	**Upper-deck end-furring pieces** (Fig. 285)	7027	Y. P.	--	----------	--	3 ft. 11¾ in. x 2 in. x 1¼ in	Nailed to upper-deck head-rafters	
85	1	**White duck** (Not Ill.)	7023	----	--	----------	--	No. 10.	Is now laid all over the upper-deck in thick paste composed of whiting mixed with linseed oil and japan, carefully stretched and tacked all around to the sides of the ventilator eaves-rails and hood-bows, after which	
86	2	**Ventilator eaves-moldings** (Not Ill.)	7028	----	--	----------	--	⅝ in. half-round	Are nailed over the duck to the sides of the ventilator eaves-rails and hood-bows	Molding machine
87	2	**Ventilator hood-bow lead-moldings** (Not Ill.)	7503	----	--	----------	--	⅝ in. x ⅜ in. half-oval	Nailed over the duck to the sides of the corners of the hood-bows	
87a	1	**White-duck** (Not Ill.)	7023	----	--	----------	--	No. 10	Is laid over the lower-deck roofs in similar manner to the upper-deck and secured with	
88	2	**Lower-deck eaves-moldings** (Not Ill.)	7025	----	--	----------	--	⅝ in. x ⅜ in. half-oval	Nailed over the duck to the side top-panel (6020), *see Con. No. 47, Table No 34 and Fig. 105, Plate VI.*; the roofs then receive three coats of white-lead all over the duck	Molding machine
89	2	**Ventilator bottom-rail roof-moldings** (Fig. 293)	7026	P.	--	----------	--	27 ft. 0 in. x 2 in. x ½ in.	Nailed to the roof against the ventilator bottom-rail	Molding machine
90	--	**Platform-hoods** (Fig. 280)	7017	----	--	----------	--		As in the case of closed cars, Table No. 36, we will now take up Made independently during the progress of construction already described, and consisting of	
90a	2	**Platform-hood bows** (Fig. 284)	7020	R. E.	--	----------	--	15 ft. 0 in x 1¼ in. x 1¼ in.	Steamed and bent to shape on a former, each having:—	
					2	Gains	a	1¼ in x ⅜ in.	For platform-hood shoulder-carlines (7018), Fig. 283	Multiple gainer
					8	Gains	b	¾ in. x ⅜ in	For platform-hood rafters (7019), Fig. 282	Multiple gainer
91	2	**Platform-hood shoulder-carlines** (Fig. 283)	7018	A.	--	----------	--	7 ft. 1¼ in. x 1 9-16 x 1¼ in.	Steamed and bent to shape on a former, each having:—	
					2	Gains	a	1¼ in. x ⅜ in.	To interlock with gains (a) of the platform-hood bows, to which they are secured with 4 No. 12 x 1 in. steel screws	Multiple gainer
92	8	**Platform-hood rafters** (Fig. 282)	7019	A.	--	----------	--	1⅛ in. x ¾ in.	Steamed and bent to shape on a former, each having:—	
					2	Gains	a	¾ in. x ⅜ in.	To interlock with gains (b) of the platform-hood bows, to which they are secured with 16 No. 10 x 1 in. and 16 No. 10 x ¾ in. steel screws	Band saw
92a	58	**Roofing-boards** (Fig. 280)	7016	P.	--	----------	--	3 in. x ¼ in.	Beaded, nailed to platform-hood bows, shoulder-carlines and rafters	Flooring machine
92b	1	**White-duck** (Not Ill.)	7023	----	--	----------	--	No. 10	Is now laid and stretched over the roofing-boards in soft white-lead paint, tacked to the bows and further secured by	
93	2	**Platform-hood iron-moldings** (Fig. 281)	7504	W. I.	--	----------	--	4 ft. 0 in. x ¾ in. half-round	Nailed to the middle portion of the bows over the duck, and	
94	4	**Platform-hood moldings** (Not Ill.)	7029	P.	--	----------	--	⅝ in. x ⅜ in. half-oval	Nailed to the sides of the bows over the duck. The duck is then given three successive coats of white-lead, and when dry the platform-hoods are attached to the car body with 28 round-head screws and washers, No. 14 x 3 in., screwed through the shoulder-carline into the end top rails, while further security is obtained by	Molding machine
95	4	**Platform-hood brackets** (Fig. 274)	7505	Bz.	--	----------	--		Screwed to the platform-hoods and corner-posts with 12 No. 12 x 1¼ in. steel screws, and bolted to the corner-posts with four bolts, 3⅞ in. x ⅜ in., round heads and bronze nuts	
96	2	**Platform-hood shoulder-carline moldings** (Not Ill.)	7030	P.	--	----------	--	½ in. x ⅜ in. quarter-round	Nailed to the end top-rails and the top of the platform-hoods, the ends joining the ventilator bottom-rail roof-moldings (7026) on each side of the ventilator	Molding machine
97	4	**Lamp-blocks** (Fig. 288)	7022	A.	--	----------	--	9⅜ in. x 7 in. x 1 5-16 in.	Nailed to the under-side of the upper-deck rafters, having a groove and hole in each for the electric wires	
98	16	**Steel-carline tin-covers** (Not Ill.)	7502	Tin	--	----------	--		Nailed to the ventilator side-posts and bottom-rail roof-moldings over the projecting portion of steel-carlines	
99	76	**Trolley-board cleats** (Fig. 286)	7031	A.	--	----------	--	9½ in. x 1⅞ in. x 1⅜ in.	Screwed to the upper-deck roof-rafters with 152 No. 12 x 1⅛ in. and 152 No. 12 x 1¾ in. steel screws	Shaper
100	2	**Trolley-boards** (Fig. 292)	7032	O.	--	----------	--	26 ft. 8½ in. x 6 in. x 1½ in.	Each in two lengths, laid side by side and screwed to the cleats with 76 No. 16 x 3½ in. steel screws	Planer
101	1	**Trolley base-block** (Fig. 289)	7033	O.	--	----------	--	2 ft. 0 in. x 14 in. x 2 in.	Screwed to the center of the trolley-boards with 12 No. 16 x 3½ in. steel screws	Planer
102	--	**Upper-deck landings** (Fig. 291)	7034	A.	--	----------	--		Are now screwed to the upper-deck roof on opposite corners with 8 No 12 x 2 in. steel screws; the two of them are composed of:—	
102a	6	**Upper-deck landing-battens** (Fig. 291)	7036	A.	--	----------	--	17⅝ in. x 1⅞ in. x ⅜ in.	To which are screwed	Planer
103	16	**Upper-deck landing-slats** (Fig. 291)	7035	A.	--	----------	--	3 ft. 2¼ in. x ⅞ in. x ¾ in.	With 40 No. 9 x ¾ in. steel screws	Molding machine
104	--	**Lower-deck landings** (Fig. 290)	7037	A.	--	----------	--		Are screwed to the lower-deck roof on opposite corners with 8 No. 12 x 2 in. steel screws; the two of them being composed of:—	
104a	6	**Lower-deck landing-battens** (Fig. 290)	7039	A.	--	----------	--	21⅝ in. x 1⅞ in. x ⅜ in.	To which are screwed	Band saw and planer
105	20	**Lower-deck landing-slats** (Fig. 290)	7038	A.	--	----------	--	3 ft. 2¼ in. x ⅞ in. x ¾ in.	With 52 No. 9 x ¾ in. steel screws	Molding machine
									The work preparatory to painting the whole of the outsides except the posts can now be undertaken as follows:—	
									1st and 2d days—One coat of lead thinned with turpentine; a little oil is added (very small amount for iron-work) and a little dryer laid all over. 3d day—Fill all holes and depressions with putty. 4th day—Scrape in all iron work with a preparation in paste form of keg lead, dry lead, whiting, gold size and rubbing varnish. 5th day—Apply a coat of roughstuff. 6th day—Rub the roughstuff to a smooth surface. 7th day—Apply a coat of ground color tint. The interior and posts are treated with a coat of wood filler, a coat of white shellac, one of coach rub varnish and one of coach finish varnish left in gloss, 24 hours between each coat.	
									The cars are now ready for their platforms. *See Table No. 38, Con. No. 106 and Plate X.*	

Number of Distinctive Pieces	40	(Column 1)
Total Number of Pieces	446	(" 2)
Number of Bolts	84	(" 6 and 10)
Number of Screws, about	732	(" 6 and 10)
Number of Nails	(?)	
Total	1262 +	

37.)



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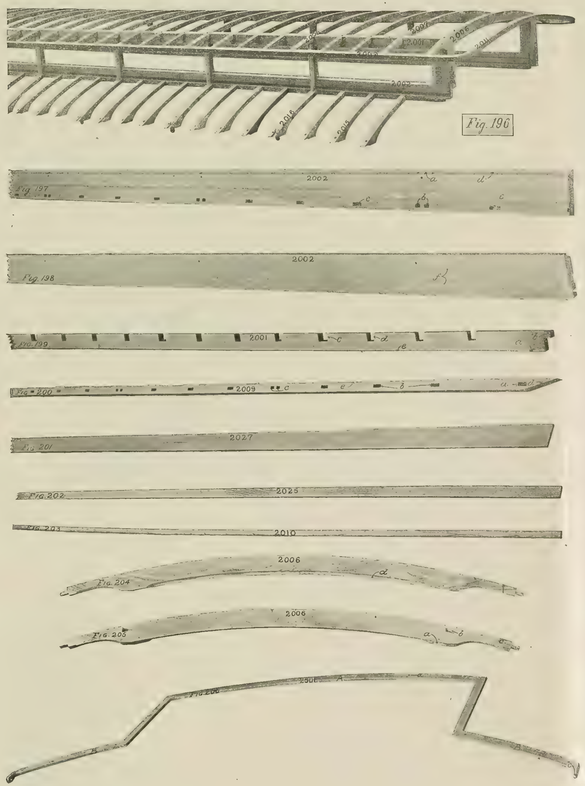
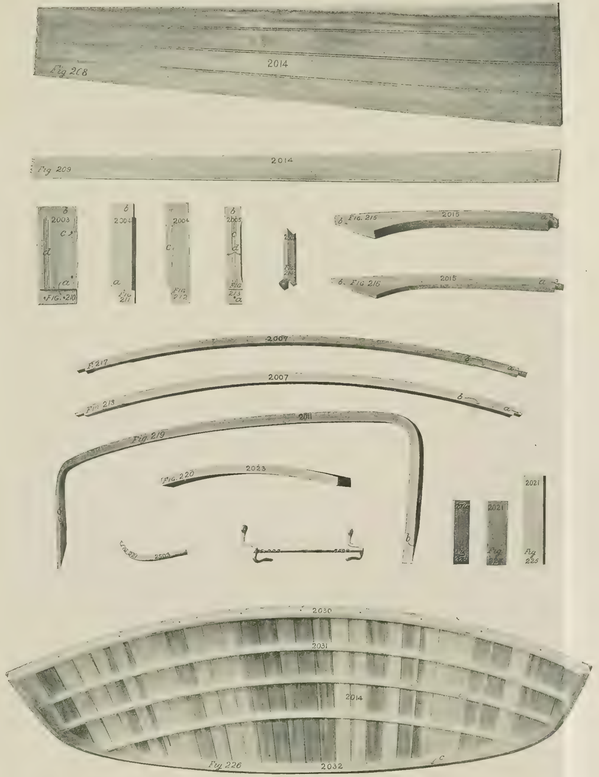
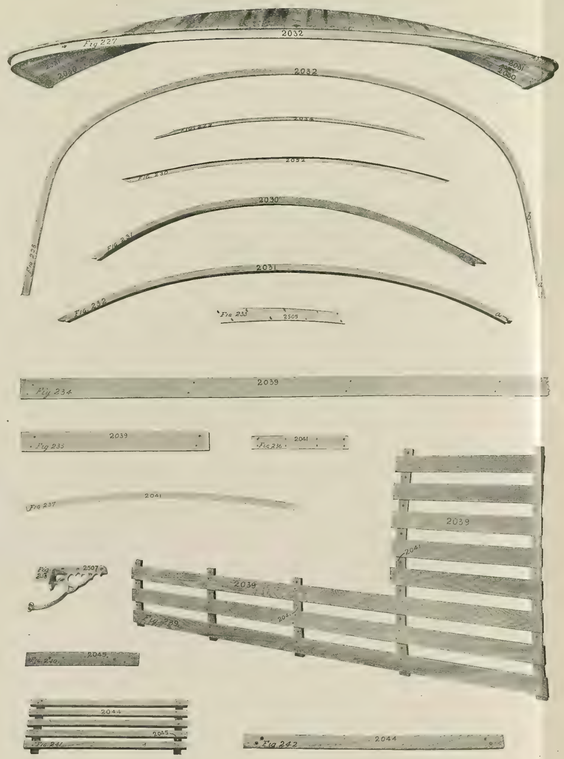
BOSTON CLOSED CAR. (Table No. 37.)



BOSTON CLOSED CAR. (Table No. 37.)



BOSTON CLOSED CAR. (Table No. 37.)



BOSTON CLOSED CAR. (Table No. 37.)

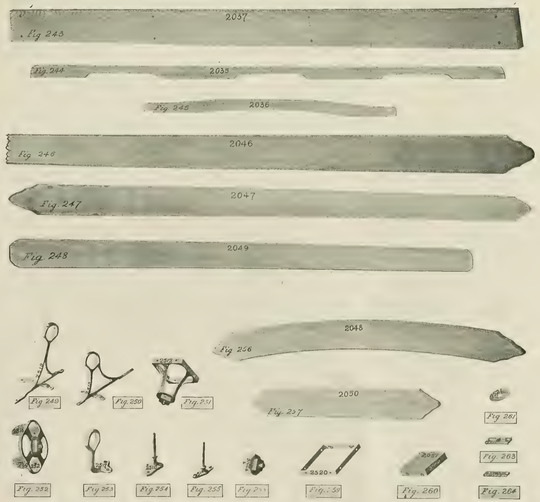


PLATE VII. [Figs. 196 to 264]

DETAILS OF ROOFS AND BONNETS OF

BOSTON CLOSED STANDARD CAR

ILLUSTRATING

STREET CAR BUILDING

(Stephenson Practice)

By

Charles Henry Davis, C. E.

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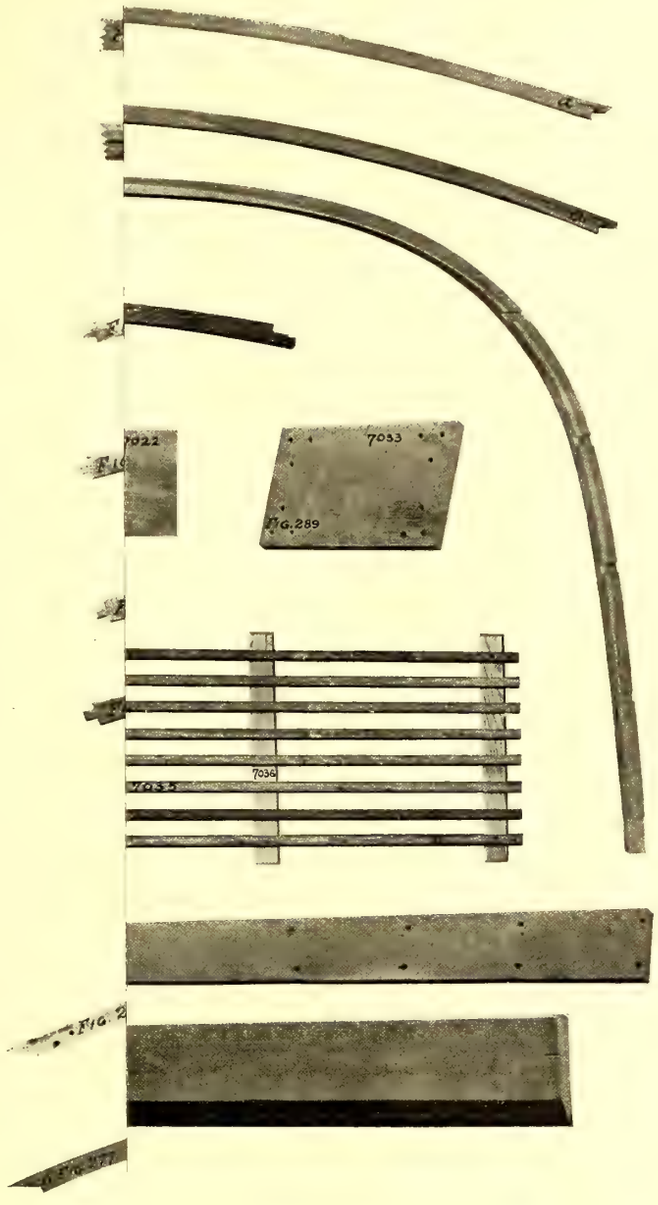

65 to 293.]

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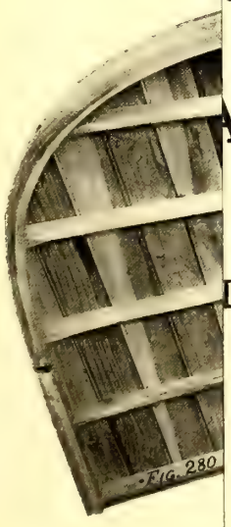
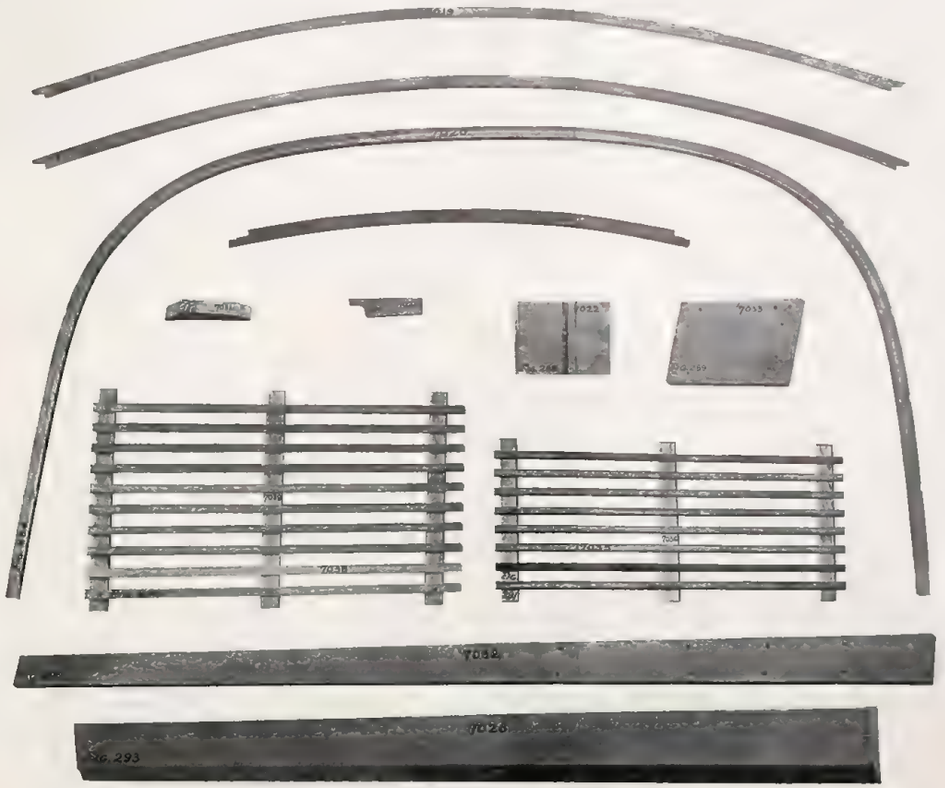


E.

BROOKLYN OPEN CAR. (Table No. 36.)

BROOKLYN OPEN CAR. (Table No. 36.)



[PLATE VIII. Figs. 265 to 293.]

DETAILS OF ROOFS AND BONNETS OF

BROOKLYN OPEN STANDARD CAR

ILLUSTRATING

STREET CAR BUILDING

(Stephenson Practice)

By

Charles Henry Davis, C. E.

LEGAL NOTES AND COMMENTS

Edited by J. Aspinwall Hodge, Jr., of the New York Bar*

The Statute of Limitations and the New York Elevated Railroad Litigation

The history of the litigation against the elevated railroads of New York for damages and for injunctions, or for damages in lieu of the latter, on account of the taking of the easements of light, air and access from the owners of property abutting on the road, has reached, during the past year or two, a new stage.

Most of the elevated railroads now operating in the city of New York were opened during the years 1878, 1879 and 1880, and thus twenty years have now elapsed and the question arises as to whether or not, where no claim has been made upon the road and no action has been brought, the road has not acquired title to the easements of light, air and access by prescription or adverse possession.

During the first decade of the twenty years, that have elapsed, very little was accomplished on behalf of the property owners in the courts; but, during the last decade, the litigation has been fierce and active, and is probably unparalleled in the history of English or American law, both as to the number of actions, the variety of legal questions involved and the amount recovered against a single defendant. The recoveries have ranged from a few dollars a foot to nearly $2,500 per foot—the latter price having been awarded in two actions brought against the road by the respective owners of the two bank properties on the corner of Wall and Pearl Streets, extending along Pearl Street for a distance of about 80 feet,—the judgments for alternative relief and past damages aggregating nearly $190,000.

In these actions the six years statute of limitations has been held to apply and to prevent the recovery of past damages for more than six years prior to the beginning of the action. The ten years' statute of limitations has been held to have no application to the recoveries. Now that the twenty years have elapsed the question of title in the defendant road, of the easements by adverse possession, must soon be passed upon by the courts.

Already it has been presented, but the court has never been obliged to definitely pass upon it, as it may now be presented. It has arisen because the old Greenwich Street Road, which ran where the lower part of the Ninth Avenue Road now runs, was opened in 1869, ten years before the present system was put into operation. It was at first operated with an endless chain or cable, stationary engines being situated under ground at Cortlandt, Franklin, Bethune and Twenty-Second Streets. There were but two stations. A couple of years later one dummy and three cars were operated, and additional stations were opened from year to year, and engines and cars added, the increase being very gradual, until in the year 1877 the line was operated from Fifty-Ninth Street to South Ferry with twenty-one engines and thirty-five cars. This was superseded by the double track of the present Ninth Avenue line, which was opened on May 1, 1880.

In various suits brought against the road by property owners in Greenwich Street after the year 1889 (that is, twenty years after the opening of the original single-track cable road), the counsel for the Manhattan Railway Company urged that the road had acquired the easements of light, air and access by prescription, having been in adverse possession of them for twenty years.

But it was at once pointed out and afterward maintained by the courts through the Court of Appeals that the rule is unvarying and long established that, where title by prescription is claimed, it must be shown by the claimant that he has been in possession, not only, of a part but of all, that he claims, continuously, for the entire period of twenty years, and that this rule applied to the Greenwich Street cases. He cannot even claim, as a partial defense, title to that part of the property or easement which he has had for twenty years, but his defense is thrown out of court, if it be shown, that he has taken more, after the twenty years began to run, than he had at the beginning.—(*American Bank Note Co. vs. El. R. R., 129 N. Y., 252; Prentice vs. Geiger, 74 N. Y., 341.)*

This was manifestly the case on Greenwich Street, and on the whole line from South Ferry to Fifty-Ninth Street, for the light, air and access taken by the original structure of what was known as the "one-legged road" was very much less than that taken by the structure as it was enlarged, or rather, rebuilt, in 1879 and 1880.

The Second Avenue line was opened to Sixty-Fifth Street March 1, 1880, and to the Harlem, Aug. 16, 1880.

The Third Avenue line was opened to the Grand Central Depot, Aug. 26, 1878, and little by little was opened to the Harlem by Dec. 30 of the same year.

The Sixth Avenue line was opened to Fifty-Eighth Street June 5, 1878, and little by little was extended through Fifty-Third Street to 155th Street and Eighth Avenue by Dec. 1 of the following year.

To anyone who is familiar with the increase of traffic upon the elevated railroads in New York it does not need much legal acumen after a careful consideration of the facts and of the law which we have already given, to see that a strict application of the law to the facts as they have occurred since 1879 will necessarily lead to the conclusion that there are very few pieces of property in the city of New York where the road can successfully claim title by prescription.

For ever since the opening of the present system there has been a constant increase in all the branches and sections of the system in New York, not only in the number of stations, but in the number of engines and cars, and hence in the number of trains. Not many years ago the station platforms were lengthened so as to accommodate trains of five cars, in place of three and four, which formerly were the rule. Heavier engines have been built and are now universally used. Tracks are heavier, and in a large portion of the city a third track has been built. The amount of light and air and access which is kept from the property owner by the structure itself has been increased in many parts of the road by the increase in the size and number of the girders and in many cases by putting solid, in place of latticed girders. Along a large portion of the road a third track has been constructed, and express trains operated upon it.

Each and every one of these alterations tend to increase the amount of light and air and access of which the property owner is deprived. The damage done him by noise has been increased.

It has been held that where a person claimed adverse possession of the right to pollute a stream of water with sewerage, claiming that he had been possessed of the easement for twenty years, and where it was shown that pollution was gradually increased during the twenty years, he cannot maintain any title by prescription.—(*Goldsmidt vs Tunbridge, 1 Eng. L. R. Eq., 160.)*

According to the sworn testimony of the highest officials

* Communications relating to this department may be addressed to the Editors, Johnston Building, 30 Broad Street, New York.

of the road the limit of the train capacity of the present structure has been reached. Without increasing the number of tracks at present existing the road cannot run more trains than it is running to-day; certainly, not during the crowded hours, which is the only time when more trains are needed.

Thus far we have assumed that title by prescription of the street easements can be secured by a company operating an elevated railroad, provided they operate it without increasing the burden upon it, continuously, for twenty years or more under an adverse claim of right. But there is very serious doubt in the minds of a large portion of the legal fraternity as to whether street or highway easements can be acquired by prescription at all, however uniform, however continuous, and however long continued may be the occupation. They point out that each act of the road operated without title to the easement is a tort in the form of a trespass, and gives the right to an action, and these recurring rights are only barred by a six years' statute of limitations, and that these same acts can be enjoined in a suit of equity whenever they occur, whatever may be the frequency and history of past acts of a similar character. There are authorities which would seem to support their contention, but if the proposition is as clear to the courts, as it appears to us, that the elevated railroad has taken more and more of the easements as each increase has been made in the burden imposed upon their structure, then the question as to whether title can be procured by prescription where the burden is not increased for twenty years will not arise for many years to come.

In many cases adverse possession could not in any event be successfully set up, for where the property has been owned by infants or others laboring under similar disability, the period of such disability is not allowed as part of the twenty-year period. H.

CHARTERS, ORDINANCES, FRANCHISES, ETC.

ALABAMA.—Carriage of Passengers—Rules of Carrier—Ejection of Passenger—Question for Jury—Instructions.

1. A rule of a street railway company requiring colored passengers to occupy seats in the front end of its cars, and white passengers to occupy seats in the rear end, is a reasonable regulation.

2. When the existence of a rule of a carrier requiring white and colored passengers to occupy different parts of the same car is established by the evidence, and its violation is shown, the reasonableness of the rule is purely a question of law for the court, and not a mixed question of law and fact.

3. Where plaintiff, a passenger on an electric car, alleged and proved that the ejection from the car was committed jointly by the conductor and motorman, it was not error to charge the jury to find for defendant if they believed from the evidence that the motorman did not aid or assist in ejecting her.—(Bowie vs. Birmingham Ry. & Elec. Co., 27 So. Rep., 1016.)

DELAWARE.—Constitutional Law—Obligation of Contracts—Corporations—Revocation of Corporate Charter or Rights—Street Railways—Traffic Agreements—Franchises—Right to Question—Injunction—Equity—Estoppel.

1. Const. 1831, art. 2, sec. 17, authorizes the Legislature to incorporate "with a reserved power of revocation by the Legislature." Held, that such provision became a part of the charter of corporations subsequently formed, and that the Legislature might exert that power at any time.

2. The provision in Const. 1831, are 2, sec. 17, authorizing the Legislature to incorporate "with a reserved power of revocation by the Legislature," permits the withdrawal of a single right or privilege without revoking the whole franchise.

3. The revocation contemplated under such clause may be either direct or by necessary implication by the passage of an act necessarily inconsistent with some right or privilege possessed by an existing corporation.

4. An act giving a street railway company a franchise to construct lines in certain streets of a city, in which another existing corporation has been granted the exclusive franchise, impliedly revokes such exclusive privilege under the power reserved in the Legislature by Const. 1831, art. 2, sec. 17.

5. An act providing for the construction of a street railway from outside the city required that it be constructed to the boundary line of the city at U Street, and that it should be completed in a certain time. A supplement to such act provided that the road might be extended from a point at which the railway intersected the boundary line, through and along G Avenue, etc., and extending the time for completion. The road, as actually built, did not run to the intersection of the boundary line at U Street, but directly to G Avenue. Held, not a sufficient compliance with the conditions of the charter, and the rights of the corporation thereunder were forfeited, although a strict construction of the statute would necessitate an acute angle in the road.

6. An exclusive right granted to a street railway company to operate its line in a city is such a property right as will entitle it to raise by injunction the question of forfeiture, by failure to perform the conditions, of the charter of a company, which is granted the right to build a street railway in certain streets of the same city.

7. A franchise to a street railway corporation giving it exclusive right and privilege of locating, constructing, operating, and maintaining a city railway within the limits of a city, designating the route of the road, and giving the further privilege of building anywhere within the city, on condition of obtaining the consent of the City Council, is an exclusive franchise as to all streets in the city.

8. Grants of an exclusive franchise to a street railway company to operate a "city railway," which provides, among other things, that steam power shall not be used unless with consent of the Council, and that bells shall be attached to the horses, does not mean, because of the use of such words, and of the fact that horse power was the only power then in use, that the motive power shall be limited to steam or horse power, or prohibit the use of electricity, so that the grant of a right to another company to use electricity would not be a violation of the franchise.

9. A charter for an electric railway company authorized it to make a traffic agreement with a street railway company in an adjacent city, stipulating that the former company should not build its tracks within the limits of said city. Subsequently the former company was granted a franchise to build a street railway line in said city. Held, that such a traffic agreement was ultra vires and void, as being in restraint of competition.

10. A court of equity will not enforce by injunction a traffic agreement between two railway companies by which one of them is restrained from competing with the other.

11. A traffic agreement between two street railway companies, by which one is restrained from competing with the other, does not estop the latter to question the corporate existence of the former, such question not arising out of the contract.—(Wilmington City Ry. Co. vs. Wilmington & B. S. Ry. Co., 46 Atl. Rep., 12.)

NEW JERSEY.—Taxation—Assessment—Correction—Real Estate—Certiorari.

1. A mistake of an assessor in listing as personal, property described in terms showing it to be real estate, may be corrected, even after the duplicate has been delivered to the collector.

2. An electric street railway is real estate, within the tax laws.

3. When it is sought, on certiorari, to set aside a warrant for sale of real estate for taxes on the ground that the prosecutor is a purchaser in good faith, against whom, as such, the tax lien has been lost by failure to make timely return to the County Clerk, and the proof of such status is not satisfactory, the writ should be dismissed, and the prosecutor be left to his defense against a possible purchaser at the tax sale.—(State [Newark & H. Traction Co., Prosecutors] vs. Mayor, etc., of Borough of North Arlington et al., 46 Atl. Rep., 568.)

NEW YORK.—Repeal of Statute—Effect—Pending Cases—Appeal—Street Railways—Consent of Abutting Owners—Crossing Railway.

1. Under Laws 1892, c. 677, sec. 31 ("Statutory Construction Act"), providing that the repeal of a statute shall not affect or impair rights accrued or acts done before it takes effect, a pending appeal, in proceedings by a street railway company to acquire the right to cross the tracks of a railway company at a point where they intersect a highway on which the street railway tracks are laid, was not affected by the enactment of Laws 1897, c. 754, which made changes in the procedure to acquire such right.

2. On appeal from the decision of a referee, the appeal will not be disposed of on a theory not presented to the referee.

3. Under Laws 1890, c. 565, sec. 91, providing that street railways shall not be built in the highways of a town without the consent of the town boards; and sec. 12, providing for the procurement of the right of one road to cross the tracks of another, and for determining the manner thereof and the compensation to be paid therefor—a street railway company owning a road which is to be built from one town into another, which has obtained the consent of the authorities of a town within which a crossing is to be made to the use of the highway of such town by the street railway com-

pany, may maintain an action to acquire the right to cross the tracks of a railway company which intersects the highway on which the street railway company's tracks are laid, though it had not the consent of the other town into which it proposed to build its road.

4. Under Laws 1890, c. 565, sec. 91, providing that a surface street railway shall not be built on any street or highway without the consent of the owners of one-half in value of all the property abutting on the street, a consent by the requisite number of the abutting property owners given to certain promoters of a proposed corporation, their assigns and legal representatives, to the construction of a surface road, which is subsequently assigned to a corporation, is sufficient to authorize the construction of a surface street railway in the highway by the assignee, and a railway over whose tracks the street railway company has instituted proceeding to procure a right to cross at a point where they intersect the highway cannot question the sufficiency of such consent.—(Geneva & W. Ry. Co. vs. New York Cent. & H. R. R. Co. Same vs. Fall Brook Ry. Co., 57 N. E. Rep., 498.)

NEW YORK.—Transfer of Passengers—Action—Complaint.

1. Under Laws 1890, c. 565, sec. 101, providing that no corporation operating a street surface railway under that chapter or chapter 252 of the Laws of 1884, shall charge more than 5 cents for one continuous ride from any point on its road, or on any line or branch operated by it or under its control, to any other point thereof, a complaint in an action by a passenger on a surface railway line against the company for its refusal to transfer him from one of its lines to a connecting line, which does not allege that the company was organized under the provisions of Laws 1890, c. 565, or Laws 1884, c. 252, is demurrable.

2. Same. Under Laws 1890, c. 565, secs. 103-105, providing that street surface railways may contract for the use of any other company's road, and providing that every such corporation entering into such a contract shall carry passengers between any two points on the railroads embraced in such contract for a single fare, a company leasing another connecting company's road, and operating it, is not bound to transfer a passenger riding from a point on the defendant company's original line to a point on the leased line where it intersects a line subsequently leased by defendant, to the line so subsequently leased, since the three roads are not united by one contract.—(Mendoza vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 745.)

NEW YORK.—Contract—Construction—Breach.

1. An agreement between plaintiff's assignor and defendant reciting that defendant should, on foreclosure sale of certain property, furnish the money required to purchase the property, "at such price as may hereafter mutually be agreed upon," will be construed as calling on each party to use reasonable efforts to agree on a price which should be bid for the property; and, if defendant refused to make such efforts, such refusal would be a breach of his contract.

2. Same—Correspondence—Construction. The effect to be given to correspondence between parties, introduced for the purpose of determining whether or not there has been a refusal to comply with the terms of a contract, is one of law, for the court, and should not be submitted to the jury.

3. Same. Defendant agreed with plaintiff to furnish the money required to purchase certain property at foreclosure sale, at a price thereafter to be agreed on. Prior to the sale, defendant's directors passed a resolution declaring that not over a certain sum should be bid, and transmitted a copy of the resolution to plaintiff. Plaintiff, by letter, stated that he was not satisfied with the amount fixed. Defendant answered that it stood ready to carry out the original agreement. Plaintiff wrote that defendant could not, if necessary to secure the property, bid less than an amount stated, which was greatly in excess of the amount fixed by the directors. The contract contemplated the reorganization of the company owning the mortgaged property, of which plaintiff owned a majority of the stock. The letter stated that the essential part of the agreement was that defendant should buy at the sale for the lowest amount practicable, and that the details of the reorganization were the only matters left to subsequent mutual agreement. Held, to show a refusal by plaintiff's assignor to negotiate as to the price to be paid, and not to show that defendant had refused to negotiate, or had arbitrarily fixed a limit for the amount which it would bid.—(Smith vs. United Traction & Elec. Co., 63 N. Y. Suppl., 665.)

NEW YORK.—Transfers—Ejectment of Passengers—Tort.

1. Where plaintiff was ejected from one of defendant's cars, and accused of having picked up his transfer in the street, because the conductor who issued it had punched it to read 2:40 p. m. instead of 3:40 p. m., by mistake, plaintiff was entitled to sue in tort for damanges for the expulsion, and the humiliation and injury to his feelings caused by the insulting remarks of the conductor, and was not limited to an action for the breach of his contract for transportation.

2. Same—Nonforcible Expulsion. That plaintiff left one of the defendant's cars in the middle of the block, at the command of the conductor, without waiting to be forcibly expelled, did not prevent him from suing for being wrongfully expelled.

3. Same—Exemplary Damages. Where plaintiff was put off of one of the defendant's street cars, in the mud, at the middle of the block, and accused of having picked up his transfer in the street, because the conductor who issued it had erroneously punched it to read 2:30 p. m. instead of 3:30 p. m., he was not entitled to recover exemplary damages.—(Eddy vs. Syracuse Rapid Transit Ry. Co., 63 N. Y. Suppl., 645.)

NEW YORK.—Highway — Unlawful Use — Action — Parties Plaintiff. An action to enjoin a corporation from constructing a street railway on a highway, and to compel it to remove a track already laid without lawful authority and to restore the highway to its former condition, can be brought in the name of the town, under Highway Law, sec. 15, authorizing the highway commissioners to bring an action in the name of the town "to sustain the rights of the public in and to any highway in the town."—(Town of Eastchester vs. New York, W. & C. Traction Co., 63 N. Y. Suppl., 1032.)

NEW YORK.—Parties—Corporations and Stockholders.

1. The stockholders of a corporation are neither necessary nor proper parties to an action to enforce an agreement of a third person to hold an assignment of a franchise for the benefit of the corporation, where the corporation does not refuse to sue; they not being persons having an interest in the subject of the action and in obtaining the judgment, within Code Civ. Proc., sec. 446.

2. Demurrer—Misjoinder of Plaintiffs. A complaint is demurrable because a plaintiff is neither a necessary nor proper party; Code Civ. Proc., sec. 488, subd. 5, permitting a defendant to demur on the ground that there is a misjoinder of parties plaintiff.—(Havana City Ry. Co. et al vs. Ceballos et al, 63 N. Y. Suppl., 417.)

WASHINGTON.—Taxation — Property Subject — Corporate Franchises—Assessment—Board of Equalization—Valuation.

1. Corporate franchises are taxable.

2. A board of equalization, which received affidavits and all information tendered, and heard arguments of counsel in support of an application for a reduction of assessments, cannot be said to have arbitrarily refused to receive testimony in support of such application, merely because it failed to pass on an offer on the part of one of the property owners to swear a witness, who afterward stated his views, together with others having knowledge of the values of the properties assessed.

3. It is only when taxing officers have acted maliciously, fraudulently, arbitrarily, or oppressively, that their determination of values will be disturbed.

4. A corporation had notice that its franchises were assessed, where the assessor, before returning the roll to the board of equalization, at a time when he could lawfully make corrections, inserted the word "franchises" in the column entitled "Other Property," without changing the valuation, and its officers subsequently appeared before the board and applied for a reduction of the assessment.—(Spokane St. Ry. Co. vs. Spokane County, 60 Pac. Rep., 132.)

LIABILITY FOR NEGLIGENCE

MICHIGAN.—Liability for Negligence — Injuries — Bicycle Rider—Contributory Negligence. Plaintiff was injured by a street car when attempting to cross the track on a bicycle. He was going at the rate of four to six miles an hour, and did not look for the car till he was on the track. If he had looked, he could have seen the car in time to have stopped or turned aside. Held, that the plaintiff could not recover for the negligence of the company in running the car at an excessive speed and not ringing the gong, as his own negligence contributed to the injury.—(Bennett vs. Detroit Citizens' St. Ry. Co., 82 N. W. Rep., 518.)

NEW YORK.—Appeal—Review—Collision—Admissibility of Evidence—Instructions—Province of Jury—Negligence—Pleading—Special Damages.

1. An objection that certain evidence was immaterial and irrelevant as no part of the negligence charged, and as not showing negligence, did not raise the objection that the evidence, if it showed negligence, was not such negligence as contributed to plaintiff's injury.

2. Evidence of omission to sound a street-car gong at a place where the law did not require it to be sounded is admissible as a part of the history of the transaction, and as bearing upon the degree of care exercised by the street-car employees, and upon the question of plaintiff's contributory negligence.

3. Sufficiency of evidence to sustain a verdict cannot be reviewed in the Court of Appeals, where the decision below was unanimous.

4. An instruction that, if the jury believed that an accident occurred as described by plaintiff's witnesses, then plaintiff is entitled to recover, is not open to the objection that it prevents the

jury from construing the evidence and determining the facts established; such charge being equivalent to an instruction that, if the facts claimed by plaintiff were established, she was entitled to a verdict.

5. An objection that instructions to find for plaintiff if the jury believe that an accident occurred, as described by his witnesses, is not open to the objection that it prevents the jury from construing the evidence, where another instruction gives the jury the same power if witnesses for defendant are believed.

6. Testimony that plaintiff's "heart was affected, that the dorsal muscle on the right side was paralyzed, and that she had trouble with her menstruation, suffered from vertigo, and had curvature of the spine," is not admissible under a complaint, alleging that plaintiff received "severe and painful contusions to her head, body and arms, and lacerated her scalp, and whereby she sustained severe nervous shock and concussion of the brain, and injured her eyesight, and she was for a time rendered unconscious, and she thereby sustained permanent injuries, and was injured for life."—(Kleiner vs. Third Ave. R. R. Co., 56 N. E. Rep., 497.)

NEW YORK.—Collision at Crossings—Evidence—Negligence—Instructions—Presumption.

1. In an action to recover for injuries by a collision of two street cars at a crossing, the fact that one of the cars was first on the crossing is not conclusive proof that such car had the right of way, but, in the absence of evidence as to the relative position and speed of the two cars as they approached the crossing, it constituted evidence from which the jury might have inferred that the car first on the crossing was entitled to precedence; and that the car first on the crossing was nearly over when struck is admissible to throw light on the relative position of the cars.

2. In an action to recover for injuries by the collision of two street cars at a crossing, an instruction that the accident raised a presumption of negligence against the company on whose car plaintiff was not a passenger, requiring an explanation on its part, is erroneous, since, not being the carrier, it was bound only to exercise ordinary care in the management of its cars, and, as there were two actors in the collision, it might have been due entirely to the fault of one party, and not at all to the fault of the other.

3. The mere fact of the accident raises a presumption of negligence on the part of the carrier, which makes it incumbent on the company carrying the passenger injured to show that it occurred without negligence on its part.

4. There was but little evidence as to how the accident occurred. It appeared, however, that the car in which plaintiff was a passenger had nearly crossed over the other company's track when it was struck by its car. Held, that it was error to charge, as a matter of law, that the company on whose line plaintiff was a passenger had offered no explanation of the cause of the accident, to rebut the presumption of negligence arising from the fact of the accident, since the relative position of the cars at the time of the accident should have been considered in determining whether or not the company was negligent.

5. In an action against two street railway companies, jointly, to recover for injuries sustained by reason of a collision at a crossing, an instruction that defendants were liable in case the jury should find that "the collision can be attributed to the want of reasonable care on the part of defendants" is erroneous, as their liability depends on whether or not, as a fact, it was attributable to their negligence.—(Londoun vs. Eighth Ave. Ry. Co. et al., 56 N. E. Rep., 988.)

NEW YORK.—Attorney and Client—Lien of Attorney—Enforcement as Against a Defendant—Practise. The practise of forcing an attorney's lien for his compensation, given by Code Civ. Pros., sec. 66, as against a defendant, who has settled with his client without his knowledge, by action, and not by motion, is not affected by the amendment of 1899, providing that the court, "on petition of the client or attorney, may determine and enforce the lien," as the amendment does not, in terms, relate to a defendant, but merely aims to formulate a practise applicable as between an attorney and his client.—(Rochfort vs. Metropolitan St. Ry. Co., 63 N. Y. Suppl., 1036.)

NEW YORK.—Negligence—Extent of Injuries—Evidence.

1. Where plaintiff, an actress, suing for injuries sustained, testified that on joining her company, some weeks after the accident, she was so ill as to seldom be able to attend rehearsals, and was under a doctor's care all the time; that her manager well knew how ill she was; and that she was finally compelled by sickness to stop work—it was error to exclude testimony of the manager as to what he had observed as to her physical condition during that period.

2. Same. Where plaintiff had testified that she was forced to disband her theatrical company through ill health due to injuries sued for, and not because of her incompetency as an actress, it was error to exclude the testimony of her manager as to why the company was disbanded.—(Farrell vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 709.)

NEW YORK.—Negligence—Instructions.

1. In an action for injuries caused by plaintiff's wagon colliding with a street car while he was driving across defendant's tracks, an instruction that if, just before the accident, the wagon was driven alongside the track and it was turned into the track in front of the car, the verdict must be for the defendant, was properly refused, since the turning into the track might have been far enough in front of the car to have given the gripman ample time to stop the car and prevent the accident.

2. Same — Special Damages — Allegation — When Necessary. Where injuries for which recovery is sought do not necessarily result from those described in the complaint, they must be alleged as special damages; and an injury to plaintiff's eye could not be recovered for on an allegation of injury to the head and brain, since it did not necessarily result therefrom.—(Geoghan vs. Third Ave. Ry. Co., 64 N. Y. Suppl., 630.)

NEW YORK.—Excessive Damages—Personal Injuries. Plaintiff, a teacher, was injured by the sudden stopping of defendant's street car, on which she was a passenger; the injury being a dislocation of a cartilage in each knee, with other injuries to her body. She expended $1670 for medical services, and was confined to her bed about ten weeks. At the time of the trial, eighteen months after the accident, she could not go up and down stairs without pain, and, in consequence of her condition, had to give up her position of general superintendent in a school. Held, that a verdict of $15,000 should be set aside as excessive.—(Kraemer vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 619.)

NEW YORK.—Malicious Prosecution — Evidence — Judicial Proceedings. An action for malicious prosecution will not lie against a defendant for having illegally arrested plaintiff without a warrant, and having brought him before a police court, where he is discharged without the filing of a complaint; an essential element of malicious prosecution being a commencement of judicial proceedings.—(Barry vs. Third Ave. R. Co., 64 N. Y. Suppl., 615.)

NEW YORK.—Damages—Evidence—Pleading.

1. Where the complaint alleges that plaintiff received a "wound at the right upper angle of the forehead; also a fracture of the skull, concussion of the brain, and a fracture of the nasal bone," he cannot introduce evidence of hysteric epilepsy, unless that condition resulted immediately and necessarily from those injuries.

2. Special Damages. Where it appears from the evidence that the hysteric epilepsy from which plaintiff suffered did not result immediately and necessarily from the injuries set out in his complaint, a motion to strike out the evidence of this condition on the ground that plaintiff has not pleaded it as a basis for special damages should be sustained.—(Ackman vs. Third Ave. R. Co., 65 N. Y. Suppl., 97.)

NEW YORK.—Personal Injuries—Earning Capacity—Excessive Damages.

1. Where the evidence in a personal injury case does not show that plaintiff's injuries have, or will, affect his earning capacity to any great extent, a verdict for $5000 is excessive.

2. Same—Stipulation for Reduction—New Trial—Plaintiff's Option. Where a verdict for personal injuries is found excessive, plaintiff will be given the option to stipulate for a reduction of the recovery to an amount deemed proper by the Appellate Court, or to have the order of the trial court denying defendant a new trial reversed.—(Kaplan vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 91.)

NEW YORK.—Personal Injuries—Negligence—Trial. Plaintiff (a woman sixty years of age), before starting to cross the street in the middle of a block, stopped and looked, and saw that there was no approaching car nearer than one in the next block, and that it was slackening its speed at the crossing. There was evidence tending to show that the motorman had applied the power at the corner, that the speed increased until plaintiff was struck, that no bell was rung, and that the motorman's head was turned, and he was talking with a person inside the car. Held, that whether plaintiff exercised reasonable care, and whether defendant was negligent, should have been submitted to the jury, and it was error to nonsuit plaintiff.—(Killen vs. Brooklyn Heights R. Co., 62 N. Y. Suppl., 927.)

NEW YORK.—Injuries—Defective Track—Proof. Where the complaint, in an action against a street railway company for an injury resulting from the defective condition of a certain part of its track, alleges that such road was operated by the defendant company, and the answer admitted the operation thereof, it was error to dismiss the complaint because the evidence failed to show that defendant was prima facie liable for the defective condition of the track.—(Schnell vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 67.)

The International Tramways and Light Railways Exhibition

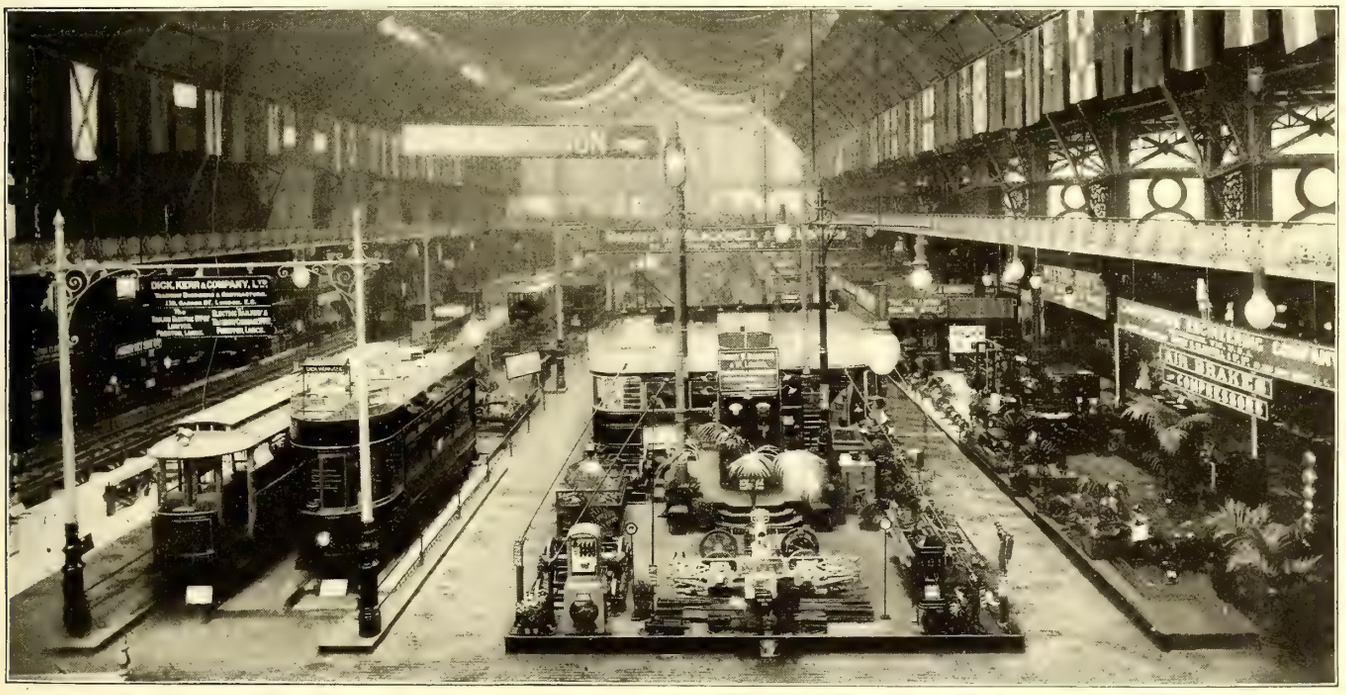
(From Our Own Correspondent.)

The opening of the International Tramways and Light Railways Exhibition at Agricultural Hall, London, on June 27, has already been chronicled in these columns, but the lateness in the month of the opening date prevented the publication in the July issue of any of the papers presented, or of any views of the exhibits. The exhibition, which was under the patronage of many prominent railway managers and municipal corporation officials in the United Kingdom, was the largest and most successful event of the kind ever held in Great Britain, and great interest was taken in it, as the large attendance testified.

THE EXHIBITS

From the different views of the exhibition which are published it will be seen that the large hall was amply filled with exhibits of cars, overhead-line equipment, track, generators, motors, etc.; in fact, all that goes to make a successful tramway installation.

THE BRITISH WESTINGHOUSE ELECTRIC MANUFACTURING COMPANY, LTD., had a space which extended the whole length of the hall, a little more than 300 ft., in which the company had erected a perfectly equipped conduit system, on



GENERAL VIEW OF EXHIBITION FROM ENTRANCE

which was a very handsome car, built to the company's designs, by George T. Milner & Company, of Birkenhead. The conduit was all above the floor, and its working parts were readily examined by those interested. The power for operating the car was furnished by a Westinghouse three-cylinder gas engine, rated at 112 B. H. P., direct coupled to a 75-kw, 500-volt Westinghouse generator. A fine panel switchboard, fitted with the usual switches, circuit workers and instruments controlled the circuits. The car was equipped with two No. 49 multipolar motors, fitted with the usual Westinghouse controller. The car was also equipped with an electromagnetic brake (Newell patents), which, in addition to braking the wheels, also magnetically grips the rail, and by an interesting system of levers, the effect on the wheel rims is not changed by the application of the track brake. The car was a handsome example of the most modern British pattern, constructed by George T. Milner & Company, and was mounted on Brill trucks. It was double-decked and could seat twenty-eight persons inside and thirty-six outside. The car was equipped with an electric-bell system for the passengers, inside and outside, and was equipped also with electric heaters. The working of the electric brake was also shown on other models exhibited, and there were also Baldwin trucks for light railway work. The Westinghouse electro-pneumatic control system for trains of cars was also shown by a full size working model of two cars equipped with complete apparatus, showing in train work the advantages of distributing the power among several motors throughout the train. It only remains to say that the car on the conduit system made regular trips during the whole period of the exhibition without mishap, and was generously patronized, nearly all visitors having a ride on it before leaving the hall.

DICK, KERR & COMPANY, THE ENGLISH ELECTRIC MANUFACTURING COMPANY, AND THE ELECTRIC RAILWAY & TRAMWAY CARRIAGE WORKS, LTD.—Moving to the right the next exhibit was that of the three companies mentioned, which was in the nature of combined exhibit, Dick, Kerr & Company acting as selling agents for the other two, and showing a most comprehensive collection of examples of permanent way construction and electric tramway rolling stock and accessories. Cars naturally formed a large part of the exhibit, four different types being shown, as follows: 1. Bogie vestibuled top seat for heavy city service, fitted with a Bellamy reversed staircase, and capable of seating sixty-four passengers. The car was mounted on Brill maximum traction trucks, and the motors and controllers were by the English Electric Manufacturing Company. 2. Bogie cross-bench car for high-speed summer suburban service, with a seating capacity of fifty-five passengers, mounted on equal wheel bogies, and with four-motor equipments, and equipped with air brakes and axle-driven compressors. 3. Four-wheel top-seat car of the improved Preston type, fitted with Bellamy reversed stairway, with a seating capacity of fifty-six passengers. 4. Four-wheel single-deck car, equipped with air brakes, with axle-driven compressor, and having a capacity of twenty-six passengers. Needless to say all these cars were built by the Electric Railway & Tramway Carriage Works, of Preston, and the whole electric equipment was supplied by the English Electric Manufacturing Company, of Preston. All were extremely well finished and thoroughly handsome samples of what the company is daily doing at its extensive Preston works. In addition to the cars a truck was shown fully equipped with motors and air brakes, the motors, controllers, etc., being of the Short system, and the brakes and the compressors being on the standard air-brake system. A number of samples of tramway permanent way was shown, varying from rails weighing 96 lbs. to the yard, with Dicker patent continuous joints, to rails weighing only 65 lbs. to the yard, spiked to 9 ft. x 9 ins. x 4½ ins. timber ties. Special truck work was also shown with points 7 ft. 6 ins. long, built from rails weighing 83 lbs. per yard, and various rail sections and rail joints added to the completeness of the exhibit. Finally the company showed a number of standard designs of poles, brackets, and all the necessary details for overhead erection, making a most complete and artistically arranged exhibit.

ROBERT W. BLACKWELL & COMPANY, LTD.—In designing their exhibit Blackwell & Company evidently intended to show a sample of every device which enters into the construction of an electric tramway, only omitting engines and power houses, these being substituted, however, by admirable photographs and working drawings. Commencing with the permanent way, they

showed some samples of manganese steel frogs, switches and crossings, this metal being chosen on account of its extraordinary toughness and hardness, being particularly suitable for this class of work, which is subjected to excessive tear and wear. The "Chicago" rail bond was also shown in profusion, and also the "Crown" bond, which, it is claimed, is an improvement on the other. The Edison-Brown plastic bonds were also shown in an exhibit by themselves, with Harold P. Brown in attendance. Four trucks of the Peckham type were shown, namely, the "Standard" for heavy 18-ft. to 20-ft. cars; an "Extra Long" truck, with 30-in. wheels, the whole designed specially for long heavy cars; a swing bolster "Maximum Traction" truck, fitted with the latest pattern side frames, and a short wheel-base swing bolster truck, designed to take successively curves of 30-ft. radius or less. On this last truck was displayed the Price momentum friction brake, which is so constructed that it utilizes the energy of the moving car for power. A very complete exhibit of air brakes was also shown on the adjoining stand of the Christensen Engineering Company, of Milwaukee. The Hipwood-Barrett fender attracted a good deal of attention, though it failed to secure the prize offered by the association, who awarded it to an ordinary life guard. Four poles were erected at corners of the exhibit, each being different, one being a center pole and bracket for flexible suspension, a side pole and bracket for flexible suspension, an ordinary side pole and bracket, and Blackwell's standard pole and bracket. Samples of trolley wire and Ætna insulators were shown, as also two samples of conduits, one being of historic interest, having been laid by Mr. Blackwell in Allegheny City, Pa., in 1887. Various trolleys were shown, including the "Pivotal" Boston trolley, the Standard trolley, the Dwarf trolley, the Winslow trolley, and also the "Southampton" and "Dublin" types of inclosed spring trolleys. Switches and circuit breakers, junction boxes, P. & B. electrical compound incandescent lamps, and a trolley wagon took up most of the remaining part of the exhibit, though mention should also be made of the various steam devices shown, including the Bundy oil separator, patent steam traps, Siegrist lubricators, and a large number of specialties useful in electric power houses.

THE BRITISH THOMSON-HOUSTON COMPANY, LTD.—An excellent display of electric cars and various tramway devices was also shown by this company, who had an extensive space well located in the center of the hall. They showed a fully equipped car built by Hurst, Nelson & Company, of Motherwell, mounted on two Brill maximum traction bogie trucks, and equipped with two standard G. E. double motor rheostatic brake equipment. The car is fitted with the Hurst-Nelson reversed stairway, and with its open iron grill surrounding the outside seats, presented a very handsome appearance, as well as giving it the air of coolness. The other car was also built by Hurst, Nelson & Company, to the designs of J. Clifton Robinson, and was exhibited by the kind permission of the directors of the London United Tramways, Ltd., for which company the car was built. It had accommodation for thirty inside passengers and thirty-nine outside, and its interior was lavishly and luxuriously fitted up. The ventilators extend the whole length of the car, and electric push buttons are provided for the use of the passengers for communicating with the conductor. For the purpose of showing the electric equipment in detail, a standard Hurst-Nelson truck with extension springs was exhibited, on the axles of which were mounted two G. E. 58 motors, with inclosed gear cases, so arranged that the wheels were free to revolve, illustrating the complete control of the driving mechanism by the motorman. The motors were connected to a series parallel magnetic blow-out controller of the rheostatic-brake type, and showed the effectiveness of this method of electric braking. A number of automatic circuit breakers were also shown, as also resistance boxes, various trolleys, tramway recording wattmeter, electric heaters, feeder pillars, overhead material, magnetic blow-out lightning arresters, etc., etc. The company also showed a section of an underground conduit system, on which was mounted a truck equipped with contact plow, showing the method of raising and lowering the same in and out of the conduit. Altogether the exhibit was a most complete one, and showed in a clear manner the advances made in electric traction in the past few years. That it was appreciated was evidenced by the interest shown by the large number of visitors in constant attendance.

EXHIBIT OF THE BRITISH THOMSON-HOUSTON CO.

A. & F. MANUELLE, of London, showed a varied assortment of granites from their quarries at Aberdeen, Guernsey, Norway and Leicestershire, for paving purposes.

ALBION CLAY COMPANY, LTD., of Burton-on-Trent, showed some admirable samples of its stoneware conduits, arranged with circular ducts, provided with spigot and socket, and fitted with Stanford joints. The company also showed samples of its troughing for its solid system of laying cables, which is also made of stoneware, and formed with spigot and socket ends, and has, in addition, a longitudinal socket to admit of a cover being formed.

E. S. HINDEY, of London, showed some specialties in vertical boilers, horizontal steam engines, dynamos and pumps.

CHARLES CHURCHILL & COMPANY, of London, showed a most interesting and comprehensive collection of high-class American machine tools, weighing in all about 30 tons. These comprised planers, shapers, lathes, turret lathes, screwing machines, radial drills, boring mills, key-way cutters, universal milling machine, universal cutter grinder, track drills, track jacks, rail saws, rail benders, etc., etc.

ESTLER BROTHERS, of London, had a tastefully arranged booth in which they displayed hundreds of various samples of the well-known insulating material, "Ambroin." This material does not absorb moisture, nor does it deteriorate on exposure, and can be molded into any desired shape. It is used in all the overhead fittings exhibited by this company, which comprised a variety

of appliances used in the overhead construction for electric tramways. It has a very large use also in sparking shields and other insulating parts of controllers, controller handles, and, in fact, in almost any place where insulating material is used. They also showed some new forms of trolley standards for center or side running, and for top-seat or single deck cars. They showed, also, a trolley head of the swiveling type, fitted with a ball-bearing turntable, and also a number of samples of the Garton lightning arrester. A model of a conduit and surface contact system (Steudebach's combined) was also exhibited.

THE ROLLER BEARINGS COMPANY exhibited samples of roller bearings, as adapted to Peckham and Brill trucks, shafting bearings, trolley bearings, etc.

FREDERICK LELL exhibited some samples of steam separators, grease extractors, automatic exhaust valves, jet condensers, as well as a "Bemis" truck. He also showed some handsome photographs of the Ball & Wood engine.

EDWARD BENNIS & COMPANY, of Bolton, showed an interesting machine stoker and self-cleaning furnace at work. This furnace has been adopted by many of the tramway companies, as it raises steam rapidly, and any class of coal can be used.

VIEW OF EXHIBITION FROM REAR OF HALL

G. F. ZIMMER, of London, had on exhibition models of the Kreiss patent swinging conveyor, which, by means of vibrations, conveys coal or other material with a very small expenditure in power.

DOCKER BROTHERS, of Birmingham, showed some samples of varnishes and paints suitable for tramway cars.

THE KLEIN ENGINEERING COMPANY, of Manchester, exhibited models of its patent water coolers, used in conjunction with condensing engines at power plants. Oil separators were also shown, and a number of interesting photographs, showing Klein's counter-current jet condensers in course of erection at the Liverpool Corporation's new electric power house at Lister Drive.

LE CARBONE showed samples of carbon brushes, which are the principal specialty of this firm, as well as carbon-contact pieces, carbons for arc lamps, crucibles, primary batteries and a number of articles in use where carbon is a necessity.

THE OHMER SYNDICATE, LTD., exhibited a ticket-recording machine, which is 5¾ ins. square by 1¾ ins. deep, and weighs about the same as the ordinary ticket punch. It is intended to be worn by the conductor on a belt, is loaded with a roll of blank paper, has a time clock on its face, and can issue up to 3000 tickets if necessary. It adds the cash taken, records the number of passengers carried, and exposes the figures to the conductor and passengers.

TANGYES LIMITED, exhibited a portable hydraulic wheel press, tested to 50 tons, for putting on and taking off one railway wagon or tramcar wheel at a time, taking solid wheels up to 27 ins. diameter, and spoke wheels up to 36 ins. diameter. They also showed a hydraulic rail bender, manufactured by themselves, a gas engine, an oil engine and a steam engine, all in operation, and also showed a quick-speed governor for steam engines, and a useful lifting tackle.

THE JOSEPH DIXON CRUCIBLE COMPANY made an exhibit of graphite for lubrication, graphite pipe-joint compound, silica graphite paint, graphite greases, graphite resistance rods and graphite dynamo brushes.

THE ST. HELENS CABLE COMPANY, of Warrington, had a booth tastefully ornamented with samples of its various cables and insulated wires for traction and lighting purposes.

BABCOCK & WILCOX, LTD., of London, exhibited a handsome model of their well-known boiler to a scale of one-eighth. To describe this exhibit would be, therefore, simply to describe the B. & W. boiler, the model being complete in the smallest detail, and being one of a number which the company is now making for its numerous branch offices. The model also showed a Babcock & Wilcox patent superheater, consisting of solid drawn-steel tubes, expanded at the ends into wrought steel cross-boxes.

JOSEPH OWEN & SON, LTD., of Liverpool, had a unique exhibit, comprising samples of every variety of English and foreign timber used in the bodies of tramcars and other vehicles, of which this company makes a special feature.

THE WORTHINGTON PUMPING ENGINE COMPANY, LTD., of London, showed a small compound pressure feed pump, a type largely used in power stations where high pressure is carried. The company also showed a number of photographs and white prints of Worthington pumps, heaters, and of various types of its self-cooling condenser.

S. Z. DE FERRANTI, LTD., of Hollinwood, Manchester, showed, in a neatly decorated space in the entrance to the hall, and not in the main hall proper, one of their well-known 50-light rectifiers, and a number of their high-tension oil fuses. They also showed a number of extremely handsome photographs, beautifully executed, of their engine and dynamo combination, both vertical and horizontal, central station switchgear, high-tension switchgear, high-tension dynamo switchgear, high-tension oil break switch, maximum capacity 500 amps. at 2000 volts, high-tension plug fuses and blocks, open type rheostats, and a number of other specialties. These photographs were of large size and well arranged, and made quite an interesting exhibit.

THE VACUUM OIL COMPANY, of Rochester, had an elaborate exhibit, under the management of its London office, of its specialties, such as cylinder and valve oils, engine, dynamo and shafting oils, and patent automatic sight-feed lubricators.

THE LORAIN STEEL COMPANY showed some interesting samples of track construction, such as has been used in Newcastle-on-Tyne, Liverpool, and many other cities. The exhibit comprised a number of rail joints, electric-welded joints, portable cross-overs. The company also exhibited a Dupont truck having a wheel base of 5 ft. 6 ins., and a length over all of 13 ft. 4 ins.

THE ELECTRO MAGNETIC TRACTION COMPANY, LTD., showed a working model of a new system of electrical traction constructed under closed conduit surface contact system. The system is yet in its experimental stage, and no actual work has yet been done.

MOSSBERG ROLLER BEARINGS, LTD., had a neat little exhibit showing the application of roller bearings in various ways. They showed a pair of carriage wheels fitted with their patent roller bearings, one motor, car and wheel similarly fitted, and a tramway car axle box, and a various selection of small straight and end-thrust roller bearings.

W. F. DENNIS & COMPANY, sole agents in the United Kingdom for Felten & Guilleaume, of Germany, had a very attractive exhibit in which they showed the "Neptune" type of rail bonds in various lengths, both solid and flexible. They also showed trolley wire of the highest quality, in long lengths, weighing over 500 lbs., with specially soldered joints of a strength equal to the wires before drawing. Paper insulated cables for feeders, with single concentric, bi-concentric and stranded conductors for

low and high tension, were also shown in various forms, and guard wires, span wires, commutator bars and various covered wires, and bronze wires of all description were exhibited.

THE CHLORIDE ELECTRICAL STORAGE SYNDICATE, LTD., of Clifton Junction, Manchester, utilized its space to the very best advantage possible, by arranging in a very attractive manner numerous samples of storage batteries, as used for pressure regulation on numerous electric tramways and railways throughout the world. The various examples of different sized cells at present working in connection with electric tramway systems in Great Britain were easily identified by the printed cards attached to each. It was evident from the thoroughness of this exhibit that the storage battery is now forming an important part in central-station equipment, both for lighting and power work, affording an excellent means of allowing the steam engines to work during a large part of the time at their most economical load. The steam plant in stations which are thus equipped requires only to be sufficiently large to develop the average load, the storage battery supplying anything in excess and storing up any surplus. Samples were also exhibited of small batteries for the

VIEW OF THE WESTINGHOUSE EXHIBIT

automatic lighting of carriages on electric railways in the event of a breakdown at the power station, and batteries for self-contained cars, auto-cars, etc.

THE BRITISH INSULATED WIRE COMPANY, of Prescott, Lancashire, had a very tastefully decorated booth, in which were mounted samples of B. I. W. patent paper-insulated cables, as used for tramways in Aberdeen, Glasgow, Manchester and many other important cities. The company also showed a sample of a three-phase cable, as made for the Isle of Thanet tramways. This cable is being used as a three-phase feeder to the sub-transforming stations, with rotatory transformers transmitting power over 10 miles, the continuous low-tension current being supplied from the sub-stations through ordinary tramway feeders. The three conductors are separately insulated with impregnated paper, then stranded up together, and finally lead-sheathed under a hydraulic pressure of 3 tons to the square inch. This cable is made for a working pressure of 2500 volts, and is tested up to 10,000 volts. Samples of the company's well-known solid system, disconnecting joint boxes, etc., were also exhibited, while its standard section pillars in use at St. Helens, Blackpool and other towns were also shown, these having mounted on them switches of the duplex-knife type, four-line plug fuses with shield, lightning arresters, etc., etc. All these devices are carefully insulated from the slate with ebonite bushes, as is also the slate from the cast-iron pillar, and each pillar is equipped with a telephone set and board of trade terminals.

THE ELECTRIC TRAMWAYS EQUIPMENT COMPANY, of Birmingham, had erected a most practical exhibition of all its British-made overhead line material, and had a large sign over its stand with the words, "British-Made Overhead Line Material," which attracted considerable attention, as it is practically the only house in Great Britain which is manufacturing such material exclusively. In the company's booth, which was tastefully decorated, were shown samples of the company's insulators of the following types: Straight-line suspenders, single and double pull-offs, car-house suspenders, bridge suspenders, and bracket arm suspenders. A sample of the flexible bracket arm suspender was also exhibited, and a number of cap and cone insulators in straight line, single and double pull-offs, etc. A large assortment of the various forms of strain insulators was also shown, made of the "Verus" insulation, which the company claims is the first, and so far the only, insulation for trolley lines made in England. These comprise Globe strains, Brooklyn strains, Globe terminals, Globe turnbuckles, etc., and, in addition, a number of bronze ears for straight work and for curves, the latter being of a heavy section, and arranged for suspending by two insulators, this company being the first to introduce this principle. In addition the company had various samples of anchor ears, splicing ears, feeder ears, and a large number of section insulators, frogs and switches, car-house frogs with movable tongues, and all kinds of overhead crossings fixed and adjustable, and, in fact, every piece of apparatus necessary for the complete equipment of overhead-line construction.

MILLER & COMPANY, LTD., of the London Road Foundry, Edinburgh, had W. Gordon, one of its directors, in constant attendance, who succeeded most admirably in making a very attractive exhibit out of its car-wheel specialties. An exhibit of such material is hard to describe, as it only showed chilled car wheels and chilled iron points, but these were arranged in such a manner as to give an admirable appearance, and evidently attracted a great amount of attention from the electrical engineers and representatives of the various authorities and corporations who were present. The exhibit of chilled car wheels was interesting, as showing a sample of some wheels which have run over 100,000 miles with horse cars. With electric motor car wheels, in which it is now doing a large business, its wheels compete with any wheel which is made either in this country or America. It also showed a working model of a system of chilled iron double shifting points, as supplied to the Naples Electric Tramways, a system which has proved thoroughly efficient in service, and which has no spring to be clogged or get out of order. It also showed a wheel press, designed to work either by belt or hand—or fitted with both systems—up to 150 tons total pressure. Another design was also shown which is supplied for specially heavy work, capable of a total pressure of 250 tons. These are designed for pressing on or off the wheels on to shafts, and have been supplied to a great number of tramway companies in this country, on the Continent and in the colonies. The machines are of simple design, made of specially strong material, and every press is thoroughly tested before it is dispatched from the workshops.

THE J. G. BRILL COMPANY.—In addition to the Brill truck, which this company presented for view under a number of cars in the exhibition, the company had at the exposition its very latest and most complete type of convertible car—that is a car which can be made either a closed car or an open car at will. The windows and sides of the car, when open, are carried into the roof and can be lowered or raised at will. The company also showed samples of its 27-G pivotal truck, the 21-E truck, and a maximum traction truck. Most of these trucks are in extensive use in Paris and Great Britain, and are being widely adopted for the new work which is being done; also some handsome bronze models of these trucks which attracted a great deal of attention, and which, being mounted on tables, were readily accessible and could be examined carefully with ease. The company also exhibited a sample of its "Dedenda" gong, fitted on a stand ready for operation, and a number of brake handles were also shown in different patterns.

THE BRUSH ELECTRICAL ENGINEERING COMPANY contented itself with exhibiting one large car fully equipped. It was a bogie vestibule car, arranged to seat forty-four passengers in two compartments, divided into two classes if desired, or into smoking and non-smoking, the entrance being in the middle. The car was mounted on bogie maximum traction trucks, and its principal dimensions were: 39 ft. 6 ins. long, 6 ft. 10 ins. wide, and 4 ft. 8½ ins. gage. Each truck was equipped with a four-pole iron-clad motor, with ventilated armature and laminated pole

pieces, and was rated at 25 hp. The field coils are wound on brass spools, are of easy renewal, and the bottom half of the motor is made to hinge downward, either with or without the armature bearings. A series panel controller with emergency electrical brake and interlocking handles was also shown, and the company's regenerative tramway controller was attached, by means of which the weight of a car descending a gradient can be utilized to generate the current and return the energy to the line. The company also had on exhibition its type H. D. 2 of controller with electrical service brake, on which is a series parallel con-

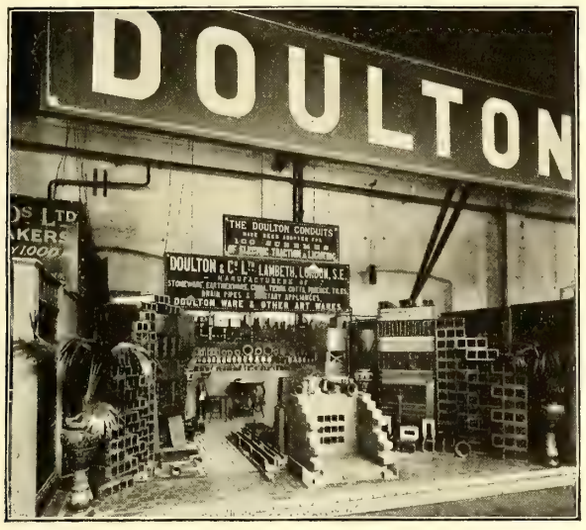


EXHIBIT OF DOULTON & CO.

troller with rheostatic brake, by means of which the speed of a car can be easily reduced, either gradually or suddenly, in case of emergency. The car, which was not equipped with top seats, attracted a lot of attention, and was favorably commented upon.

DOULTON & COMPANY, LTD., had an interesting exhibit tastefully arranged of its various manufactures in glazed stoneware conduits for electrical purposes. It also showed insulators and all kinds of stoneware and porcelain for electrical purposes, crucibles for electro-chemical manufacturing purposes, and a large assortment of tiles and faience now being extensively used in the walls and floors of power stations, where their cleanliness and durability render them particularly suitable. In addition, it exhibited also Doulton's patent water softeners and filters, which are now in successful operation in a large number of electric light and power stations.

CROSSLEY BROTHERS, LTD., had in operation two types of its well-known gas engines, viz.: Type S, giving 19 actual hp, and type O E, arranged for driving a dynamo for electric lighting without accumulators. Its latest type of oil engine, known as L L, was also shown, giving 2½ actual hp on a constant working load, and being equipped with all the latest improvements.

THE OHIO BRASS COMPANY, under the charge of A. G. Harwood, who has recently come across to represent the company in Europe, had a very handsome exhibit in the shape of a pyramid, displaying all the various insulators which it makes, such as trolley wire hangers and ears, strain insulators, section insulators, etc., etc. Surrounding the space was a brass railing, at the corners of which wood and iron poles were arranged, equipped with its well-known types of flexible pole brackets, one pole being equipped with a flexible bracket on which a suspension yoke was fitted for supporting two parallel trolley wires. The company also showed a great variety of section insulators, cross-overs of various styles and design for both round and figure 8 wire, and, in addition to the overhead material displayed, a variety of motor and car supplies, as well as a complete line of track bonding material, such as steel and copper bonding caps, channel pins and various styles of rail bonds. A number of adjustable track brush holders with steel wire track brooms and a Monarch track cleaner for the removal of snow, ice and dirt from tramway tracks also formed part of the company's exhibit.

MELDRUM BROTHERS, LTD., of Manchester, had an attractive space containing a sample of their well-known "Koker" mechanical stoker of the coking type, in combination with the well-known forced draft. They also exhibited the Meldrum "Simplex" destructor, as working in connection with the Darwen Electric Supply Station, where the town's refuse supplies all the power for the works. There was also shown a Beaman & Deas' destructor used for steam raising, and an econometer, an instrument for testing chimney gases, and thus readily discovering and remedying defective combustion.

ELLIOTT BROTHERS, of London, had an attractively fitted up booth in which they displayed a Board of Trade panel, with all the instruments for carrying out the tests required by the Board of Trade in connection with electric tramway undertakings. This board was complete with all the instruments mounted on it, and is similar to a number of such boards which have been built by Elliott Brothers to form part of traction switchboards. They also had a galvanometer and battery for testing the difference of potential existing between insulated returns and water pipes, and a number of Weston electrical measuring instruments of various designs and for various purposes. The exhibit also included a line of their various forms of recording wattmeter suitable for testing the current on motor cars, and showing in a graphic manner the amount of current taken at starting and when going on level, uphill or downhill. These instruments keep careful record of the fluctuations of the current, and are made also for recording volts. The paper speed in these instruments can also be regulated to be run out at 6 ins. per minute or 6 ins. per hour, and a large number of other useful instruments were shown, making a most handsome and interesting display.

HAROLD P. BROWN, of New York, exhibited the Edison-Brown plastic rail bonds, which seemed to attract a great deal of attention among the electrical engineers present. Mr. Brown himself attended to the exhibit, which, though really part of R. W. Blackwell's business, was of sufficient importance and interest to warrant a special space. He showed grooved rail joints and T-rail joints, all equipped with the plastic bonds, and a portable grinder and flexible shaft for applying rail bonds without drilling holes or weakening rails. He also showed a complete electrical testing apparatus for determining the conductivity of the rail bonds, rail joints, etc., the whole exhibit being most complete in every detail.

SMITH OF NEW YORK showed a complete line of headlights for electric and cable tramway carriages. Some of these were designed for the use of oil, though the majority were designed for electric lamps. He also had on exhibition incandescent clusters and combination center car lamps, many of these being of neat design and extremely useful, being adapted either for electric light or oil. He showed also a number of signal lamps and illuminating torches, self-contained and capable of giving a light equal

EXHIBIT OF THE ELECTRIC CONSTRUCTION CO.

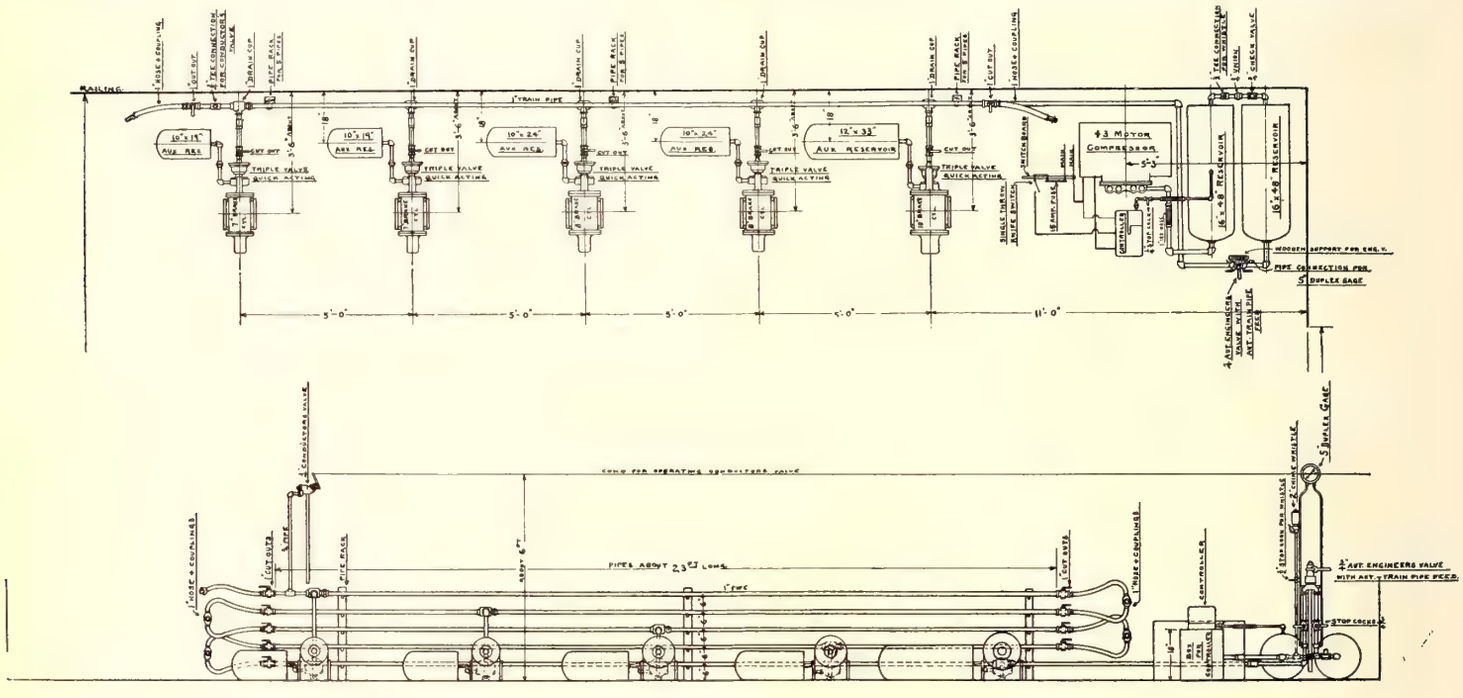
to 5000 cp, being specially interesting to railway and tramway engineers and contractors.

THE BRITISH GRIFFIN CHILLED IRON & STEEL COMPANY, LTD., had a handsome exhibit of chilled iron wheels, arranged in the shape of a pyramid, weighing 1 ton, and suspended from the center of a cast-iron test bar 12 ins. long by 1 in. square. In this company's space was also a pair of electric motor wheels which had been in service nineteen months and had run nearly 53,000 miles. One of these wheels was broken to show the fracture of the white hard iron of the chilled parts, changing very gradually into the tough gray iron of the body of the wheel. The company also showed standard motor wheels mounted on Griffin cold-compressed axles, center flange with double-tread wheel, American interurban type of wheels, Indian railway wheels

and a number of cold-finished axles in various stages of progress from the rolling mill to the finished axles.

THE BRITISH MANNESMANN TUBE COMPANY, LTD., showed a collection of standard poles as supplied by it for traction work. They are made from weldless steel tubing, and are supplied with scroll work or plain. They are made in one part or pieces, as required. The company also exhibited some samples of arc-lamp tests, as well as trolley poles, which are made of special steel with a very high elastic limit.

THE ELECTRIC CONSTRUCTION COMPANY, LTD., exhibited a 70-kw variable ratio transformer, now largely employed in the distribution of current on the Oxford system. Machines of similar construction are employed on the City & South London Railway, as reducers on the E. C. C. patented arrangement in which the high-tension pressure supplied is 1000 volts and the working conductors are 500 volts on the three-wire system. The arrangement of double field enables the ratio of the primary and secondary voltage to be varied within any desired limits, giving a high efficiency of conversion and compensation for line drop. The company also had on exhibition a tramcar motor of 30 hp, a good example of what British manufacturers can do in this line.



PLAN AND ELEVATION OF CHRISTENSEN EXHIBIT NO. 1

Stationary motors were also shown, capable of running continuously at a low temperature rise and of ability to withstand upward of 100 per cent overload for short periods. The company's exhibit also included an example of the company's trolley for side suspension, which is specially constructed for durability, lightness and the least possible risk of leaving the trolley wire or fouling the suspension brackets. Its regular switchboard apparatus was also exhibited, and the whole was supplemented by a fine series of photographs which conveyed an idea of the work which its shops are so well equipped for turning out.

THE ELECTRICAL POWER STORAGE COMPANY, LTD., showed various types of its well-known storage batteries and cells. First of all was the E. P. S. type, which is so thoroughly well known that it needs no description. Adjoining this were samples of the company's Faure King cells, specially adapted for traction work, and as used with the electric cabs in London and Paris. The company's "E" type is largely used for electric launches and also for train lighting in connection with Stone's system. The exhibit also included various types for stationary cells, which are largely used in Great Britain for railway and tramway generating stations. In addition the company showed a number of portable cells and batteries used chiefly for telephone, Roentgen ray, medical and dental work.

ASKHAM BROTHERS & WILSON, LTD., of Sheffield, had a most practical exhibition of its specialties for track construction, showing first of all a large show case containing assorted tool steel and also platelayers' tools of all kinds, such as picks, wedges, chisels, crowbars, hammers, etc. The company also showed some rail carts for the use of transportation of rails which are now a necessity with the long lengths and heavy sections which are now in use. It showed samples of its patent automatic spring points made of crucible cast steel, as supplied to Nottingham, Manchester and many other cities, as shown by a large map which it displayed. Adjoining these were movable points for junctions and cross-over roads, and crucible cast-steel crossings of various angles and sections. In another corner were also right-angle crossings, portable cross-overs for temporary track, while reconstructing, drain rails, drain boxes, springs, tires, wheels and axles and various types of joint plates and heel plates. Many samples of its special crucible steel castings for various purposes were also exhibited, as well as tiebars and fishbolts of wrought iron and mild steel. Another conspicuous feature was its patent points for cross-over roads on double lines of tramway, and, in fact, every possible piece of apparatus necessary for the complete equipment of track construction was included in the exhibit. Some very interesting protographs were also exhibited of special work which this firm has done in Sheffield, Leeds and other cities where complicated crossings have been constructed and work peculiarly difficult has been accomplished.

FRANK SUTER & COMPANY, LTD., sole agent in the United Kingdom for the Helios Electrical Construction Company, Ltd., has on exhibition some interesting samples of this well-known firm's construction. Firstly it exhibited a truck having a wheel base of 4 ft. 9 ins., the truck frame being supported on the axle boxes by means of spiral springs, and the car body being supported also on spiral and laminated springs on the frame, thus assuring quiet and easy running. Near these was also its car motor, the frame of which is cast in two pieces and arranged to open. Its controller was also exhibited, the contact cylinder of which rotates within a powerful magnetic field, which causes immediate extinction of all sparks. Its automatic maximum cut-out was also shown, and its overhead sliding contact gear which, owing to its great width, insures a reliable contact with the overhead wire. The reversing of the trolley rod is also saved, as by its elastic construction the gear changes its position automatically according to the direction in which the car is running. It also showed a complete line of overhead material with "Dirigo" insulation.

CHRISTENSEN ENGINEERING COMPANY, Milwaukee, had an exhibit of its own, although it was also represented by R. W. Blackwell & Co. It showed five different types of brakes. Exhibit No. 1 consisted of a motor-car equipment and train of four trailers with the Christensen quick-acting automatic air brake, with compressor type No. 3, provided with automatic controller, automatic engineer's valve and with automatic train pipe feed mechanism. Exhibit No. 2 represented a motor car and one trailer, with plain automatic air brake, motor compressor type AA1, with automatic governor and plain automatic engineer's valve. This exhibit was a duplicate of the equipment furnished the Cie. Générale de Traction, Paris, with the exception that the latter company is furnished with the axle-driven compressor in-

stead of the motor-driven. Exhibit No. 3 comprised one complete instruction stand representing the straight air-brake apparatus applied to a motor car. The compressor of this exhibit was also of type AA1. All the above exhibits were shown in complete operation. Exhibit No. 4 consisted of one portable air-compressor apparatus for furnishing compressed air for sand blast, air tools, air hoists, chippers, etc., etc. Exhibit No. 5 comprised various axle-compressor apparatus with governors, reservoirs and other air-brake apparatus, such as engineer's valve, triple valves, etc., which were arranged on tables for convenient inspection. Sectional parts of apparatus were also exhibited, showing the working of the parts clearly. The exhibit was in charge of the company's new European manager, W. A. Parker.

WITTING BROTHERS, LTD., of London, showed a very complete exhibit of the system as manufactured by the Electricité et Hydraulique Cie., of Belgium, and had at the exhibition standard trucks for light railways and tramways equipped with two standard tramway motors of 30 B. H. P., 500 volts, and 550 r. p. m. In this form of truck the end platforms are entirely independent of the car body. A Peckham truck was also shown equipped with similar motors. The exhibit also included a com-

VIEW OF ONE SIDE OF HALL

plete set of car fittings and electrical apparatus for handling cars, such as controllers, resistances, lightning arresters, canopy switches, etc., and various types of tramway motors of different horse-power and for operating at different voltages; also stationary motors of different sizes, both of the inclosed and semi-inclosed type, which are designed to operate at slow speed, having four poles with slotted drum armatures, with form-wound coils. The field-magnet coils are wound on bobbins, from which they are highly insulated by special waterproof and fireproof insulation; the complete coils are then slipped over the poles and kept in place by the extended pole shoes and by means of special bronze cheeks. It showed also various sizes of three-phase motors and single-phase Heyland motors, a 50-kw motor-generator, consisting of a 100-volt continuous current motor, driving a continuous current dynamo generating current at 500 volts. The two machines were rigidly coupled and mounted on the same bed-plate, and supplied power to various exhibits in the hall. It also exhibited a switchboard and various samples of cables manufactured by this company, and in addition it had an interesting collection of three-phase transformers of standard pattern, an electric percussion rock drill, automatic circuit breakers, arc lamps, switches and fuses, manufactured by the Electricité et Hydraulique Cie.

THE CONSOLIDATED CAR HEATING COMPANY, of Albany, showed an interesting collection of its various types of electric heating apparatus for tramway work, together with special switches and fuses, and special devices for work in connection therewith. The company drew particular attention to its temperature regulating switch, a device which allows the current to pass through either or both of the sets of the coils in its heater, thereby regulating the heat.

BERGTHEIL & YOUNG, of London, showed a complete line of trolley line insulators of the J. P. type, manufactured by the Johns-Pratt Company, of Hartford, Conn., the insulation being of molded mica. The company also showed samples of the Johns type of electrical heater, which provides a large radiating surface for the heat generated. It also had on exhibition a quantity of the "Noark" fuses of the inclosed type, capable of opening an electrical circuit at any of the various alternating or direct-service voltages in common use, without arc or flash, and at the same time of visibly indicating its condition.

WILKINS & COMPANY, of London, showed some interesting samples of wire ropes for various purposes. Chiefly interesting in this exhibit, however, were the ropes which it supplied for cable tramways.

HOLDEN & BROOKE, LTD., of Manchester, exhibited its specialties in steam separators, grease extraction, exhaust heads, steam injectors and other special steam and feed-water devices.

W. T. GLOVER & COMPANY, LTD., of Trafford Park, Manchester, exhibited a case of handsome samples of various kinds of its well-known cable, together with several large drums of lead-covered and steel-armored three-core cable for high-tension substation feeders, for polyphase systems, for either tramways or town lighting, and a large drum of single lead-covered cable for tramway feeders. It also showed a most interesting collection of joint boxes for single concentric, triple concentric, twin and three-core cable of all sizes, including patent closing connector to make T joint on to single cable without cutting the cable or using screw-fixed clamps. Various disconnecting, straight through and T boxes for single concentric and multi-core cables up to 1.5 sq. in. sectional area, with patent flexible links, were exhibited, together with other fittings used in cable connections. Samples also of patent solid ended flexible rail bonds with round and compressed strands were shown, and the whole exhibit was arranged in a most tasteful manner, some one of the company's engineers being in constant attendance.

FINALE

In addition to the exhibits already described, there were a number of other exhibitors of other machinery and machine tools and various appliances more or less applicable to tramway work, but which the space at our disposal prevents us from treating in detail. In the lesser hall were shown, also, a large number of novel seats designed for the tops of tramcars and omnibuses for the avowed purpose of keeping the seats dry in wet weather. It is impossible to describe them all, so that, perhaps, it will be sufficient to say that many were good, many were impracticable, but that nearly all had some points of merit. We have tried to give our readers a fairly accurate description of the chief exhibits, and if any of the exhibitors have been neglected, it is not from any desire on our part, but that they have been overlooked in the large number that were there. The exhibition, as a whole, was an immense success, reflecting the greatest credit on James W. Courtenay, the managing director, and A. M. Wilcox, the untiring secretary, and also on the exhibitors, who used the utmost diligence in getting their exhibits ready in time, and afterward keeping them in good order.

The World's Copper Output

The accompanying statement of the copper production of the world has recently been forwarded to the State Department by Vice-Consul Monaghan, at Chemnitz:

OUTPUT

Country	1898 Tons	1899 Tons	Increase P. Ct.	Decrease P. Ct.
Algeria	50	....	....	100.0
Argentine Republic	125	65	....	48.0
Australasia	18,000	20,750	15.3	....
Austria-Hungary	1,540	1,505	....	2.3
Bolivia	2,050	2,500	21.9	....
Canada	8,040	6,732	....	16.3
Cape Colony	7,060	6,490	....	8.1
Chile	24,850	25,000	0.6	....
German	20,085	23,460	11.3	....
England	550	550	....	....
Italy	3,435	3,000	....	12.5
Japan	25,175	27,560	9.5	....
Mexico	15,668	19,335	22.9	....
Newfoundland	2,100	2,700	28.6	....
Norway	3,615	3,610	....	0.1
Peru	3,040	5,165	69.9	....
Russia	6,000	6,000	....	....
Spain and Portugal	53,225	53,720	0.9	....
Sweden	480	520	8.3	....
North America	239,241	265,156	10.8	....
Totals	434,329	473,818	9.1	....

The London Firm of J. G. White & Co.

Announcement is made in London of the organization of J. G. White & Company, Ltd., as electrical, mechanical and civil engineers and contractors, with a capital of £100,000, divided into 5000—6 per cent cumulative preference shares of £10 each, and 50,000 ordinary shares of £1 each.

The directors of the company are: Chairman, J. G. White, Ph.D., president, J. G. White & Company, New York; managing director, O. H. Baldwin, M. E.; A. N. Connett, C. E., chief engineer; E. B. Wyman, director Deep Leads Electric Transmission Company; W. C. Burton, E. E., electrical engineer. The secretary and treasurer of the company is A. H. Beatty.

This company has been formed to take over the foreign business (i. e., all the present business outside of North America) of J. G. White & Company, Inc., of New York, and to carry on a general electrical, mechanical, and civil engineering and contracting business throughout Great Britain, the Continent of Europe and other parts of the world, excepting North America. No manufacturing business will be done by the company, so that its business will not compete in any way with existing manufacturing companies. By carrying out an independent policy, it is believed that the confidence of financiers, manufacturers and engineers generally can be secured and a very large business developed.

The company will have an unusually competent and experienced staff, not only of electrical, but mechanical and civil engineers as well, as will be seen below.

The company's chairman, J. G. White, was graduated Bachelor of Arts at Pennsylvania State College, 1882, and after three years' post-graduate work, largely in electrical engineering, was graduated Doctor of Philosophy at Cornell University in 1885. After two years in charge of the Department of Physics in the University of Nebraska, Mr. White formed a company to do electrical engineering and contracting, and has since been the controlling spirit and active head of the business. This business has been conducted throughout the United States under his present management and control continuously for thirteen years. During that period a large and growing business has been developed. The work done has included the partial or complete equipment of many electric railways, among the number being those in the following cities and towns: Baltimore, Md. (about 200 miles); Buffalo and Niagara Falls, N. Y.; Washington, Charleston, Asheville, New Orleans, Nashville, Omaha, St. Joseph, St. Louis, Kansas City, Salt Lake City, Spokane, etc. The business has also included the designing and installation of a number of electric plants for lighting, and the installation of, or consulting engineering work for, a large number of electric power plants. Among the latter were the Niagara Power Company, complete designing and building of transmission line; subways for the Cataract Power & Conduit Company, Buffalo General Electric Company and city of Baltimore, and transmission plants in Helena and Cripple Creek. The work now being carried out by J. G. White & Company includes the following: Washington, D. C., equipment of about 60 miles of electric road; Toledo, Ohio, to Detroit, Mich. (54 miles), complete engineering and construction of electric railway; Perth, Western Australia, consulting engineering and furnishing plant for tramways; San Juan, Porto Rico, complete engineering and installation of tramways and lighting plant; Alton, Ill., consulting engineering Alton Railway, Gas & Electric Company; Winston-Salem, N. C., consulting engineering Fries Manufacturing & Power Company, rebuilding and extending railway, etc.; Colorado Springs, Col., consulting engineering, rebuilding and extending railway, electric light plant and large new electric power plant; Victoria, Australia, consulting engineering Deep Leads Electric Transmission Company (3000 hp); Kalgoorlie, Western Australia, consulting engineering Kalgoorlie Electric Power & Lighting Corporation; State of New York, consulting engineering and valuation of properties for State Board of Tax Commissioners; St. Louis, Mo., consulting engineering Imperial Electric Light, Heat & Power Company, extension of plant, etc. During the past five years the company has also done a constantly increasing business in the forming of underwriting syndicates to finance electrical properties, all of which have shown most gratifying results. The properties financed in whole or in part included the following: Buffalo & Niagara Falls Electric Railway Company; New York Electric Heat, Light & Power Company, New York City; Helena Water & Electric Power Company, Helena, Mont.; Colorado Electric Power Company, Canyon City, Col.; Alton Railway, Gas & Electric Company, Alton, Ill.

The company's managing director, O. H. Baldwin, received the two degrees of Mechanical Engineer and Electrical Engineer in 1885 from Stevens Institute of Technology, since when he has had the following experience: In the employ of the Pennsylvania Railroad Company, maintenance of way department and motive power departments until March, 1886. With the Westinghouse Electric & Manufacturing Company from March, 1886, until September, 1889, on general construction work and operation of electric lighting and power plants. In 1889 he was sent from Pittsburgh to London to serve as engineer to the Westinghouse Electric Company, Ltd., and also to superintend the running of the Sardina Street station of the Metropolitan Electric Supply Company, Ltd. While serving in this capacity, Mr. Baldwin drew up the plans for the boilers and piping work for the extension of this station, superintended its erection, and operated the extended plant for one year. In 1892 he was appointed chief engineer of the Westinghouse Electric Company, Ltd., London. In 1894 he was appointed managing director of the company. Some time since Mr. Baldwin was given the additional appointment of assistant manager to the British Westinghouse Electric & Manufacturing Company, Ltd., and has been acting manager of the business of this large company, no manager having been officially appointed. Since 1890 Mr. Baldwin has had general charge of all the engineering work of both the Westinghouse Electric Company, Ltd., and the British Westinghouse Electric & Manufacturing Company, Ltd.

J G. WHITE

A. N. CONNETT

A. N. Connett, chief engineer of J. G. White & Company, Ltd., was graduated in 1880 as civil engineer, at Rensselaer Polytechnic Institute, Troy, N. Y. From Jan. 25 to July 3, 1881, he was in charge of the survey at St. Charles, Mo., for the river improvement works of the United States Government. From July 4 to Sept. 7, 1881, he was resident engineer at Cowden, Ill., for the construction of the Toledo, Cincinnati & St. Louis Railroad. From Sept. 12 to Dec. 3, 1881, he was assistant engineer Union Pacific Railway, in charge of division of construction work on the Oregon Short Line in Idaho. From Feb. 20, 1882, to March 30, 1884, he was principal assistant engineer to William E. Northern (deceased), a very well-known engineer and a president of the American Society of Civil Engineers. From April 1, 1888, to Sept. 12, 1888, he was assistant engineer, with Knight & Bontecin, at Kansas City, Mo., on the plans of the Twelfth Street cable line at Kansas City. From Sept. 14, 1888, to May 10, 1889, he was assistant engineer with the Bentley-Knight Company on the construction of conduit electric tramways at Boston and New York. From May 14, 1889, to March 1, 1890, he was principal assistant engineer on the plans and construction of the Seventh Street cable line, Washington, D. C., for the Washington & Georgetown Railway Company, and from March 1, 1890, to March 25, 1891, principal assistant engineer with the Baltimore Traction Company on the construction of the Druid Hill Avenue cable line. From March 25, 1891, to July 10, 1891, he was divisional engineer, Broadway Cable Railway, New York, in charge of construction of division from Fourteenth Street to Thirty-seventh Street. From July 13, 1891, to Sept. 15, 1896, he was chief engineer, Baltimore City Passenger Railway Company; built and designed for the company 21 miles cable road, including three power houses and two car houses, also 20 miles electric railway with one power house and two car houses. The last year with this company Mr. Connett acted as general manager in addition to his duties as chief engineer. From Sept. 15, 1894, to Sept. 15, 1896, he acted as chief engineer, Metropolitan Street Railway Company, Washington, D. C., designed and built 21 miles conduit electric railway with two power houses and one car house. From Oct. 1, 1896, to the present time, he has been chief engineer of the Compagnie Francaise Thomson-Houston. While in Paris Mr. Connett has had charge of the numerous and large installations which have been made by his company. These have included the surface contact tramway

at Monte Carlo, which has operated quite successfully, and was the first commercially successful tramway of this type in the world. Among his other installations the tramways at Nice, described last month, are of particular interest. In the central portion of the city the tramways are operated by conduit, while in the more outlying and suburban districts the overhead trolley furnishes power to the cars. This entire system is operated from a station some 22 miles distant, which is driven by water power. One of his most noted installations is the tramway of Paris, described in December, 1899, and which is an unusual and improved type of conduit, and which is now operating very successfully. His work in France has included other tramway installations, most of which have been built on the overhead trolley system, and his work has also included electric light and power installations.

E. P. Jones, mechanical engineer of the company, has had twenty years practical experience in mechanical engineering work, a large part of it having been in connection with mining machinery of various kinds. He was for seven years with the Union Iron Works, of San Francisco, the largest builders of mining machinery west of Chicago. Of this time he was draftsman for three years, chief draftsman for two years, and assistant superintendent for two years. He was later mechanical engineer of the Anaconda Mines, in Montana, for one year, and still later, chief draftsman of the Risdon Iron Works, of San Francisco, for nearly three years, this firm being the second largest manufacturer of machinery in the United States west of Chicago. In addition to the above, Mr. Jones spent four years in general construction, erection and operation of mining machinery, and had also two years commercial experience in manufacturing and selling machinery. All of the above experience was in the United States, and after this Mr. Jones went to Western Australia to enter the employ of Bewick, Moreing & Company, having been selected to carry out important mechanical work for this firm by its San Francisco correspondents. Mr. Jones remained with this firm for some fifteen months, and then established himself very successfully as consulting mechanical engineer in Western Australia, from which place he has just returned.

A. H. Beatty, secretary of the company, entered the services of Monkhouse, Goddard & Company, chartered accountants, of London and Newcastle-on-Tyne, in the year 1885, as junior clerk, and remained in the services of that firm until 1892. During the above period Mr. Beatty rose from the position of junior to that of senior clerk, and in this capacity was intrusted with many investigations, comprising auditing accounts, and examining into the financial position of various firms and companies, both in England and abroad. Since leaving that firm Mr. Beatty has acted as accountant in a number of important transactions involving not only commercial management, but also practically the superintendence of the mining, engineering and electrical work.

The company has certainly started under the most favorable auspices, and should secure a large amount of work in its chosen field.

Car Body Specifications

The cars used on the Southwest Missouri Electric Railway are described and illustrated elsewhere in this issue. As they possess a number of interesting features the full specifications are given herewith:

DIMENSIONS

	Feet	Inches
Length of car body over corner posts	30	6
Length of car over vestibules	40	2
Length of car over bumpers	41	2
Width of car body at sill, over plates	8	3½
Width of car body at belt rails	8	3½
Width of car body over water drip rails	8	4½
Height of car body from underside of sills to top of roof, not including trolley board	9	0
Height inside, from floor to top plate	6	3
Height inside, from top of floor to underside of upper deck ceiling	8	2
Height from track to underside of sills when car body is mounted on trucks	3	1

BOTTOM FRAMING

Side sills of very best quality long leaf yellow pine, size 4½ ins. x 7¾ ins. finished, re-enforced on the outer sides with steel plates; plates to be ⅝ in. thick, 7 ins. wide, extending full length of car body and around corners to door posts on ends in one continuous piece, and securely bolted to sills with oval head carriage bolts.

End sills of oak, size 7¾ ins. x 4⅞ ins. finished.

Cross sills of oak, size 6⅞ ins. x 2¾ ins. finished.

Diagonal braces of oak, size 4 ins. x 1¼ ins. finished.

Trapdoor framing to be arranged to meet the requirements of the ———— motor, for ———— two motors to each car, of type No. ———— and of ———— hp each.

Bottom framing to be also arranged to meet the requirements of the ———— double trucks, with wheels 33 ins. in diameter; wheel base of trucks ———— distance between centers of truck bearings ————; bolsters to be set back ———— from end of car body.

Gage of track 4 ft. 8½ ins.:

Bottom framing to be tied together with ⅝ in. round refined iron rods, one for each through cross sill, extending across the whole width of bottom frame and through side sills and plates, with thread and nut at each end.

Short framing and trapdoor framing to be also tied together with ⅝-in. round refined iron rods and plated where necessary.

Body bolsters to be made of 9 ins. x ⅞ in. and 9 ins. x ⅝ in. iron filled with oak, made to suit the requirements of the trucks and securely bolted to car body.

Truss Rods: Inside trusses to be made of 2 ins. x ½ in. refined iron, with 1-in. round ends with thread and nut. These trusses to be placed as high as possible and out into posts, and securely fastened to posts and sills.

Also truss rods of 1-in. round iron to be placed underneath side sills to support center of car, with turnbuckle in the center, and securely bolted to sills at ends.

Floor to be of best quality quarter-sawed yellow pine, ⅞ in. thick with 2⅛-in. face, tongued and grooved, closely laid longitudinally with car and securely nailed to bottom framing. Floor to be of two thicknesses, the lower layers being laid crosswise and the top floor to be laid longitudinally with car.

Trapdoors to be fitted with large wrought-iron handles, countersunk into trapdoors and bolted through.

All parts of bottom framing and under side of floor to be painted with brown oxide of iron paint, and all mortises and tenons to be thoroughly white-leaded when being put together.

BODY FRAMING

All posts, rails and other parts of body framing to be of best quality tough ash. Ventilator rails to be faced with oak on the inside and moulded.

Side of car to be framed for eleven windows on each side with straight siding below windows.

Ends of car to be framed for double doors, and one window at each side of door opening.

Posts to be well braced diagonal cross bracing between posts, made of oak ⅞ in. x 3½ ins. and tightly fitted. Outside of car below window to be sheathed with matched poplar sheathing vertically and well nailed to body framing, sheathing to be ¾ in. thick and 2 ins. wide on face.

Inner side of sheathing to be backed with best quality linen scrim well glued to sheathing, posts and bracing, and when the glue has become hardened the scrim to be painted with brown oxide of iron paint.

The joint between sill plate and sheathing to be covered with 1¼-in. x ¼-in. half oval moulding extending full length of body at sides, also on ends.

The joint between arm and rail and top edge of sheathing to be covered with 1¼-in. x ¼-in. half oval iron moulding extending full length of body and around corners to door posts on ends in one continuous piece.

Posts to be secured at bottom with strap bolts made of 1¼-in. x 5-16 in. iron, extending through sill with thread and nut at bottom. Strap bolts to have heel bent over on top and cut carefully into posts, and to be securely screwed to posts.

Posts to be tenoned, and sills and top plates to be mortised, drawbored and pinned, and all pinning to be done in such a manner that pins will draw tenons into mortises.

Top of posts to be provided with wrought-iron T-plates securely fastened to posts and top rails.

Side top rails to be of best quality yellow pine, size 4¾ ins. x 3 ins. finished, strengthened by a heavy letter panel made of ash 1⅛ ins. thick and 7 ins. wide, which is gained into top rail as well as posts.

Under drip rail to be 2¼ ins. x 2¼ ins. x ¼ in. angle iron, extending from corner post to corner post in one continuous piece and securely screwed to posts and letter panel.

Arm rail of ash, size 1¾ ins. x 4⅛ ins. finished.

Side posts of ash, 2¼ ins. thick, cut to pattern.

Corner posts of ash, 4 ins. thick, cut to pattern.

Diagonal bracing between posts of oak, size ⅞ in. x 3½ ins.

Truss plank at bottom, inside, of ash, size 1¼ ins. x 9 ins.

Door posts of ash, size 2½ ins. x 2¼ ins. Each door post shall be provided with one ⅜-in. round iron rod, extending from top of headpiece through to bottom of end sill, screwed to headpiece and let into door posts, and to have thread and nut at bottom.

ROOF

To be of the monitor-deck pattern full length of car. All parts of roof framing to be of best quality tough ash. Ventilator rails to be faced with oak inside and molded.

Lower ventilator rail of ash faced with oak, 2½ ins. x 4½ ins.

Upper ventilator rail of ash, size 2¼ ins. x 3¼ ins.

Ventilator munions of ash or oak, size 1⅜ ins. x 2¼ ins.

Side of lower deck carlines of ash, size 1⅛ ins. x 2 ins., cut to pattern, glued and tenoned into lower ventilator rail, and shouldered, glued and screwed to side top rail.

Center of upper deck carlines of ash, 1⅛ ins. x 1¾ ins., cut to pattern, glued and screwed to top ventilator rails.

Roof to be further supported by ten steel carlines, one over each intermediate side post, made of 1¼-in. x ⅜-in. steel, forged to shape of roof in one continuous piece and extending from side top rail to side top rail, with a foot at each end, which is securely screwed to side top rails. Steel carlines to be securely bolted to wood carlines.

Roof framing to be covered with matched poplar sheathing ½ in. thick and 3 ins. wide, closely laid and securely nailed to roof framing.

Outside of roof sheathing to be painted with brown oxide of iron paint, and then covered with No. 8 cotton duck, and outside of duck covering to be painted three coats of lead and oil paint before trolley board is placed in position.

Inner side of roof sheathing to be painted with brown oxide of iron paint.

The entire upper deck of roof to be covered with roof mats made of ash slats, placed on ash cleats laid in white lead, and securely screwed to roof framing.

TROLLEY BOARD

To be of best quality of white pine, made of two boards 1¾ ins. thick, 6 ins. wide and 11 ft. long, placed 4 ins. apart on center of roof, placed on ash cleats laid in white lead and securely screwed to roof.

All parts of trolley board and roof mats to be well painted with lead and oil paint.

Bolts to be provided for securing trolley pole base of stand, and to be located to suit the ———— base.

Roof mats to be placed on lower decks at diagonally opposite corners of car, also black steps on corner posts and grab handles on roof at same corners, of black.

PLATFORMS AND VESTIBULES

Platform outside knees of oak, 3½ ins. thick, 8 ins. wide.

Platform inside knees of oak, 3¾ ins. thick, 8 ins. wide.

Platform inside knees of oak, 2¾ ins. thick, 8 ins. wide.

All platform knees to be re-enforced with 5-in. x ⅝-in. iron plates extending full length of knees and securely bolted to same. Platform floor to be of best quality quarter-sawed yellow pine ⅞ in. thick with 2½-in. face, laid crosswise and securely nailed to platform framing.

Distance from top of car floor to top of platform floor 6⅞ ins. Platforms to be 4 ft. 10 ins. long from end of car body to outside of vestibule front at center of car, enclosed at front by stationary vestibule, with folding doors at both sides hung to vestibule corner posts, also folding gates for summer use. Vestibule to have three sash at front, the sash in center opening to drop, and all other sash to be stationary.

All framing parts of vestibules to be of best quality tough ash. Lower part of vestibule fronts to be sheathed with matched poplar sheathing, placed vertically same as on sides of cars, sheathing to be ⅝ in. thick and 2 ins. wide on face, and securely nailed to vestibule framing. Inner side of sheathing to be backed with linen scrim and painted same as on sides of car.

Inner side of vestibules to be finished in oak throughout, finish at bottom to be panel work, all finished in the natural color of the wood and varnish.

HOODS

To be of the street-car pattern. The bow to be of oak 1⅛ ins. x 1⅝ ins. steamed and bent to shape. The carlines to be of ash ⅞ in. x 1¼ ins. steamed and bent to shape, shouldered, glued and securely screwed to bow. Hood carlines against end of car to be of ash, 1¼ ins. x 1½ ins.

Hoods to be covered with matched poplar sheathing ⅜ in. thick and 2½ ins. wide, bent to shape and securely nailed to bow and carlines.

Outside of sheathing to be painted and covered with cotton duck, and outside of duck covering to be painted three coats of lead and oil paints.

Inner side of hoods to be painted same color as outside of car body.

Outer edge of hoods to be provided with an iron guard to prevent trolley pole from wearing out canvas covering.

SMOKING COMPARTMENT

Each car to have a smoking compartment at one end, 7 ft. 8¼ ins. long between end linings, with longitudinal side seats made of oak and varnished.

Partition between smoking compartment and balance of car to have a single sliding door, 25-in. opening.

Windows at each side of door opening in partition to be glazed with clear glass; also glass in door to be clear.

WINDOWS

Eleven on each side of car, and two at each end. Each window opening to have two sash, the upper one to be stationary and the lower one to drop flush with arm rail. All window openings at sides of car to be provided with a hinged casing covering space between sash and inside lining, which will close the opening both when sash are up and down. The lower outside end sash to be made to drop, and the inside end sash to be hinged and fitted with brass wire cloth.

INTERIOR FINISH

Interior finish of car body and vestibules to be of quartered oak throughout, of modern design and secured in place with solid black overhead screws.

End and side linings of oak, ¾ in. thick, with raised panels 9-16 in. thick.

Doors—
- Center rails of oak, 6½ ins. x 1 5-16 ins.
- Lower rails of oak, 8¼ ins. x 1 5-16 ins.
- Upper rails of oak, 4½ ins. x 1 5-16 ins.
- Side door stiles of oak, 4½ ins. x 1 5-16 ins.
- Center door stiles of oak, 4 ins. x 1 5-16 ins.
- Panel mutins of oak, 2 ins. x 1 5-16 ins.
- Raised panels of oak, 7-16 ins. thick both sides.

Sash—
- Bottom rail of oak, 3½ ins. x ¾ in.
- Top rail of oak, 3⅞ ins. x ¾ in.
- Side stile of oak, 2 1-16 ins. x ¾ in.

Deck sash—
- Lower rail of oak, 1½ ins. x ¾ in.
- Upper rail of oak, 1 3-16 ins. x ¾ in.
- Side stiles of oak, 1 5-16 ins. x ¾ in.

Transom sash in ends—
- Lower rail of oak, cut to pattern, 1¼ ins. x ¾ in.
- Upper rail of oak, 1 in. x ¾ in.
- Side stiles of oak, 1⅛ in. x ¾ in.

CEILING

Of three-ply birch veneer, plainly decorated and varnished. ceiling and ceiling moldings to be secured in place with screws, and ceiling moldings to be grooved on back to receive the lamp wires. Back of ceiling to be painted with brown oxide of iron paint.

DOORS

Automatic double doors at each end of car, made of oak with oak panels, hung at top with contra-twist door fixtures. Door in partition to be hung with hangers and track. Door openings at ends of car to be 40 ins. wide and 6 ft. 3 ins. high, and door opening in partition to be 25 ins. wide and 6 ft. 3 ins. high. All doors to have stationary glass.

SASH

All sash to be ¾ in. thick and made of oak.

DECK SASH

Eleven on each side of car, pivoted and made of oak. The ends of ventilator or monitor deck to be divided into three spaces, with pivoted sash in center opening and stationary glass in side openings.

GLASS

The glass in all windows and doors to be first quality double thick American window glass, imbedded in molded rubber on all edges to prevent rattling. Glass in deck sash to be double thick white chipped, with 1 in. clear edge and imitation bevel.

CURTAINS

All side and end windows, also outside of end door openings to be provided with curtains. Curtains to be made of Pantasote material, pattern "H" color 74, mounted on Hartshorn 1-in. spring rollers and fitted with the Burrowes No. 83 fixture at the bottom.

Curtains on outside of end doors to be made up in same manner as the other curtains, to be placed in a neat oak box over door opening with side pieces extending down to arm rail to form guides for curtain fixtures.

SEATS

There are to be eight (8) on each side of car in large compartment, six of which are to be of Hale & Kilburn's No. 80½ Walk-over pattern, and four stationary seats; the two stationary seats at end next to vestibule to be placed longitudinal with car, and the two stationary seats next to partition to be placed crosswise.

Cushions of all reversible and the two longitudinal stationary seats to be 33 ins. long and the two stationary seats next to partition to be 31 ins. long. Backs of all cross seats to be 22 ins. high, and those of the longitudinal seats to be of same height as side lining (13 ins.). All reversible cross seats to have grab handles on corner of back at aisle end, also movable foot rest and thumb latch on seat back levers. All seat cushions to be 18 ins. wide. All seat and back cushions to be covered with canvas-lined rattan with hard enamel finish. Space between center of stationary cross seat and the first reversible seat to be 37 ins. Reversible seats to be spaced 17 ins. between edges of seat cushions when passengers are facing each other, and 16½ ins. between edges of seat cushions when backs are all turned same way.

Aisle through center of car to be 20 ins. wide.

HAND RAILS

To be placed in smoking compartment only, supported by black ornamental brackets. Rails to be made of oak 1⅛ ins. diameter, with polished black ends. Each rail to be supplied with six (6) padded hand straps made of fancy leather and fitted with black buckle.

FLOOR MATS

Everett pattern, made of ash slats ⅝ in. thick, ¾ in. wide, placed ¾ in. apart, extending longitudinally in aisle full length of car and sunk flush with the floor.

TRIMMINGS

Of very best quality black metal, dead finish and secured in place with solid black screws.

GRAB HANDLES

Long vertical grab handles to be placed on posts at each side of each vestibule entrance, made of 1-in. steel-lined black tubing fitted into black end sockets, 36 ins. long, and securely screwed to posts with solid black oval head screws.

WINDOW GUARDS

Three bar window guards to be placed on outside of all end windows, made of ½-in. heavy black tubing filled with hardwood and secured in place with solid black screws.

SIGNAL BELLS

Two 6-in. steel conductor's signal bells to be supplied with each car, with necessary cords of 5-16-in. round oak tan leather extending through center of car suspended from ceiling with suitable black hangers with 13-in. drop.

REGISTER

One Meaker fare register of latest pattern to be furnished with each car, with necessary cords of 5-16-in. round oak-tan leather extending along ventilator rail at each side full length of car and onto both platforms, suspended by suitable brackets or guides.

WIRING

Car bodies to be wired for light and trolley circuits. Light circuits to be arranged for four single lights on each ventilator rail in large compartment, and two single lights in upper deck of smoking compartment.

All wiring material, sockets and switches to be furnished by the railway company.

HEADLIGHT

Each car to be equipped with one Wagenhals' electric arc headlight complete, arranged to hang on front of vestibule.

HEATERS

Each car to be equipped with sixteen electric heaters, type to be selected by the railway company.

SAND BOXES

Each car to be equipped with two (2) sand boxes—one at each end at diagonally opposite corners of car, placed under seats, arranged to operate by foot lever, and supplied with removable hose.

GONGS

Two 14-in. steel foot alarm gongs to be supplied with each car, one under each platform.

BRAKE STAFFS

One on each platform, 1¾ ins. round at the bottom, forged tapering to 1 in. round at the top, well braced, fitted with 12½-in. black ratchet brake handle and ⅜-in. twist-link Norway iron brake chain.

PLAFORM STEPS

Double steps at each platform entrance, sides of steps to be made of steel plate ¼ in. thick, with treads of ash ⅞ in. thick and 8½ ins. wide. Distance between end of car body and inside of platform crownpiece 38 ins. Distance from outside of car side to outside of platform knee 13 ins. Distance from top of platform to first step 11 ins., and from top of upper step to top of lower step 10½ ins. Distance from top of platform floor to underside of bottom step 24 ins. Distance from top of platform floor to top of car floor 6⅞ ins. Edge of bottom step to project 1½ ins. beyond side of car. Outer edge of step treads to be covered with iron molding.

DRAW-BARS

Extra heavy radiating spring draw-bar at each end of car, with necessary slides, all securely bolted to car body. Height from track to center of draw-bars when car body is mounted on trucks to be 22½ ins.

BUMPERS

Angle iron bumpers to be placed on front of vestibules, made of 6 ins. x 3½ ins. x ⅜ in. angle iron bent to same shape as vestibule front, and extending full width of same, projecting 6 ins. beyond front of vestibule and securely bolted to platform knees, which project out for that purpose. Height from track to center of bumpers to be 33½ ins.

MATERIAL AND WORKMANSHIP

All material entering into the construction and finish of these car bodies to be of the very best quality; all sills to be full length without splicing; mortises and tenons to fit each other tightly without false filling, and to be thoroughly white-leaded when being put together; all lumber to be of the very best quality and thoroughly well seasoned and dried; and all work to be done on a strictly first-class workmanlike manner.

CORNER POSTS AND HEADPIECE

To be securely tied together with an angle iron brace let into top of headpiece, corner post and side top plates. Outside of corner post, where it joins plate and headpiece, to be protected by a heavy iron plate.

Corner iron to be placed in corners of hoods where the bow joins the rear carline.

PAINTING

These car bodies to be painted in the best possible manner, lettered, ornamented and striped as desired by the railway company, and varnished throughout with Nobles & Hoare's railway varnish.

Outside of car to be painted in the following manner:

Two coats of pure white lead and linseed oil.

After second coat cars to be puttied and plastered where necessary.

Car to be rubbed with pumice stone and water until a perfectly smooth surface is obtained.

Two coats of flat body color, and if necessary an additional coat will be put on, depending on color used.

One coat color and varnish, on which striping and lettering will be done.

Two coats Nobles & Hoare's rubbing varnish, second coat to be rubbed with pulverized pumice stone and water.

Two coats Nobles & Hoare's railway body varnish. All striping to be done in gold. Lettering and numbering to be of same size and style as shown by photograph to be sent by railway company.

Roof of cars to be painted three coats of lead and oil paint, each coat to be allowed to dry before the succeeding coat is applied.

Inside work to be finished in the following manner:

All parts of inside woodwork of car and vestibule to receive one coat of oil filler, one coat of pure linseed oil, and three coats of Nobles & Hoare's rubbing varnish, last coat of varnish to be rubbed to a cabinet finish. No shellac to be used on any part of the cars.

INSPECTION

The railway company shall have the privilege of sending a representative to the shops of the car builders to inspect and examine the cars while being built.

TRUCKS, MOUNTING MOTORS AND INSTALLING ELECTRICAL EQUIPMENT

The Southwest Missouri Electric Railway Company to furnish and deliver free of any expense at the works of the car builders all necessary trucks, motors, wire, switches, sockets and all other electrical equipment for these cars, and the car builders to install same without any extra charge.

TIME OF DELIVERY

These car bodies to be delivered complete, f. o. b. cars Webb City, Mo., on or before ————, 1900, subject to delays caused by fire, labor trouble or any other cause beyond the control of the car builders.

The Adrian (Mich.) Street Railway is to be completely overhauled and reconstructed. A. P. Southworth, owner of the property, has succeeded in floating a bond issue of $25,000, and the company has received a new and favorable franchise from the city.

The Worcester Consolidated Street Railway Company has about completed the extension of its Market Street car house. The new addition will accommodate about sixty cars.

The J. G. Brill Company's Exhibit at the Paris Exposition

The J. G. Brill Company, of Philadelphia, has an exhibit of cars and trucks at Vincennes, and an exhibit of models and photographs in the American section of the Transportation Building on the Champ de Mars.

In the Transportation Building at Vincennes this company shows four types of trucks, a type of convertible summer and winter car, and a standard sweeper for meter-gage roads. One of the trucks is a No. 21-E truck of the company's standard pattern, mounted on 33-in. wheels, and having a 6-ft. wheel base and 3½-in. journals. The spring base of the truck is 14 ft. 6 ins. A No. 27 truck of standard type is also shown. It has 33-in. steel-tired wheels, and was built for standard gage, and for a car body having a weight of about 22,500 lbs. The truck itself weighs 9450 lbs., and is fitted with G. E. 55 motors. This is the type of truck specially recommended by the Brill Company for the very heaviest service.

There is also shown a No. 27-G truck, with a 4-ft. wheel base, and built for a gage of 4 ft. 8½ ins. The width in this case was restricted, so that it measured no more than 2 m at any point. The truck has 30-in. wheels, and is intended for a car body of sufficient size to carry eighty passengers.

A maximum traction, or No. 22 truck, fitted with 30-in. and 22-in. wheels, completes the exhibit of trucks at Vincennes. This maximum traction truck has a 4-in. wheel base, and is equipped with G. E. 52 motors. It is built for standard-gage tracks. The special feature of this truck, which attracts considerable attention from engineers, is the side pieces of the frame, which are solid forgings. These forgings, although an extremely difficult and intricate piece of work, have come out with perfect success, and are specimens of a high grade of workmanship. A number of these forgings are also shown unassembled. The maximum traction truck is also intended for a car body accommodating eighty passengers.

The greatest novelty of the Brill exhibit, to foreign managers, is a convertible car of standard type, mounted on a No. 21-E truck, with 33-in. wheels. The truck has a 7-in. wheel base, but is intended for meter gage. The spring base is 15 ft. 6 ins. The car has metal panels, both sash and panels sliding into the roof and making the car, when they are up, as completely open as the standard pattern.

The Brill Company also exhibits one of its standard sweepers for meter-gage roads. This sweeper, which was illustrated last month, has a 6-ft. wheel base, and is mounted on 33-in. wheels. The sweeper is arranged with two brooms and a scraper, to clean the track in front of the trail broom. It also has the usual wings for increasing the width of the space cleared. Aprons are dropped over the brooms to prevent the snow from being thrown on the sidewalk. Two motors are provided for propulsion, and one for driving the brooms. All the machinery, and what would ordinarily be the platforms, are inclosed so as to protect the men.

A swinging easel contains photographs of Brill cars and trucks in use in the United States, England, France and Germany, and a framed photograph gives a view of the company's works.

The Brill exhibit at the Champ de Mars is located in the American section of the Transportation Building, on the first main aisle when entering from the Avenue Suffren. The exhibit consists of four truck models in bronze, a swinging easel with photographs of the company's types of trucks and cars, and a photograph of the works. The four models, which are made to scale, comprise a No. 27 truck, a No. 27-G truck, a No. 21-E truck and a pair of maximum traction trucks, with frame mounted upon them, representing the floor frame of a car, and illustrating the working features of the trucks.

The photographs illustrate nearly every type of car used in America, and are of such size as to clearly show the peculiarities of American construction. There are shown, also, views of Brill cars and trucks in use in many foreign cities, which would indicate that the Brill Company does business in nearly all of the countries which have reached the state of civilization marked by the use of trolley cars. It will, therefore, not be a surprise when it is stated that in a number of the foreign sections in the Transportation Buildings at Vincennes and at the Champ de Mars are shown cars mounted on Brill trucks. In the city of Paris, Brill work is especially in evidence. In going to the Annex of the Exposition at Vincennes, for instance, one rides on Brill trucks, whether starting from the Bastille or from the boat landing at the Pont National, and when passing the Madeleine Church on one of the large double truck cars, one is carried on trucks from the same shops. It would lead too far, however, to mention all of the tram lines in Paris on which Brill trucks are used.

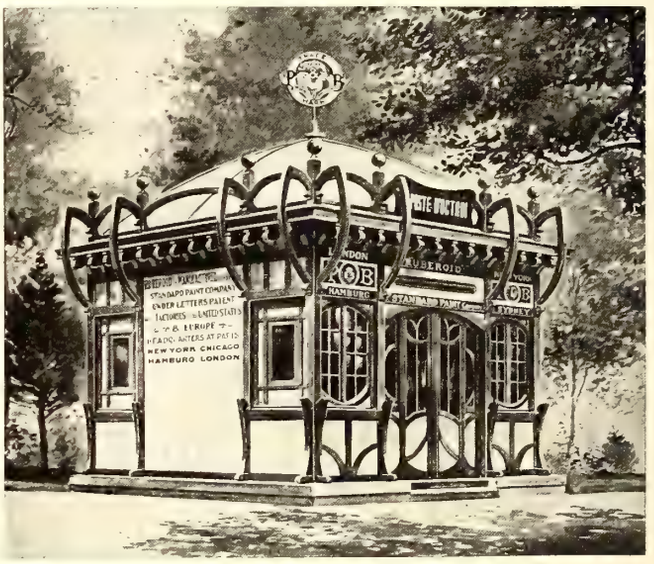
In a pamphlet prepared for the jury of the Exposition, it is stated that the Brill Works were founded in 1859, and that the beginning was on a very small scale, not more than four or five workmen having been employed, while the present number is 1400. The company manufactures annually 2000 electric cars and 9000 trucks, and the export business in 1899 exceeded f.5,200,000.

In England and on the Continent the Brill Company is represented by Maskell E. Curwen, whose headquarters are at 17 Victoria Street, Westminster, London, S. W. Mr. Mueller, the Exposition representative, has his headquarters at Vincennes.

The "P. & B." Paris Exhibit

Among the most novel of the American exhibits at the Paris Exposition is a pavilion erected by the Standard Paint Company, of New York. It is unique in construction and in its location at the Avenue d'Jena entrance. The inscription "Standard Paint Company," the American and European trade-marks and the various head offices—New York, London, Paris, Hamburg, Berlin and Sydney—appear on the front of the pavilion, while, surmounting the roof as a weather-vane, is the well-known "P. & B.," with the rooster trade-mark in gold. The trade-mark seems peculiarly fitting in a place so entirely Gallic in character, as the building itself is occupied by the officers of the Paris customs, which is indicated by the legend "Poste d'Octroi."

By special concession, after the French architects had themselves made successful use of P. & B. Ruberoid in the hallways and on the stairways of the chief operating building of the Expo-



P. & B. PAVILION AT PARIS

sition commissioners at No. 2 Avenue Rapp for more than a year before the Exposition opened, it was arranged that an ornamental pavilion, to be constructed inside and out, flooring, sides, ceiling and roof, of Ruberoid, should be erected for the use of French authorities in the Colonial section. Thus, a building purely American in material is being actually used during the term of the Exposition by the French Government. It is classified in the section of Architecture.

The Ruberoid covering the exterior is decorated in imitation of gray birch, with pilasters in oak. The roof is Ruberoid undecorated. The interior walls, above the base of imitation wood, are tastefully painted in floral designs on a delicate background, as in fresco. The ceiling is panelled and the Ruberoid elaborately decorated in allegorical design, emblematic of the American, European, Asiatic and African continents. The flooring bears a tastefully colored border in Grecian design. Though Ruberoid was in service as a decorated flooring at the recent Brussels, Sydney and other expositions, the Paris decorations are of a higher artistic grade than has heretofore been attempted. The roofs of the exposition warehouses in the Rue Javelle are also covered with Ruberoid.

In the American section (Machinery and Electricity Department) the P. & B. electrical compounds, insulating varnish and tape are shown; in the Civil Engineering and Transportation Department are the well-known P. & B. insulating papers, roofing and other products of the Standard Paint Company.

The Neal-Jupiter Brake

James H. Neal, who is connected with the Boston Elevated Railway Company, and has already made several inventions, including the Neal electric headlight, has recently brought out another invention, which is claimed to answer all the requirements of an efficient and reliable brake. The United States Steel Company, of Boston and Everett, Mass., has acquired the right of manufacture, and is now making one of these Neal-Jupiter brakes—so called after the inventor and after the brand of steel manufactured by this company. A car of the Boston Elevated Railway Company will be fitted up and in running order before the middle of August.

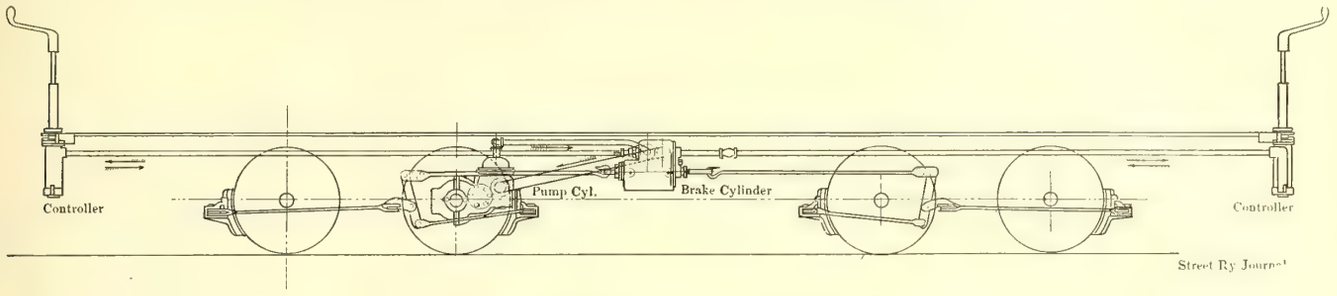


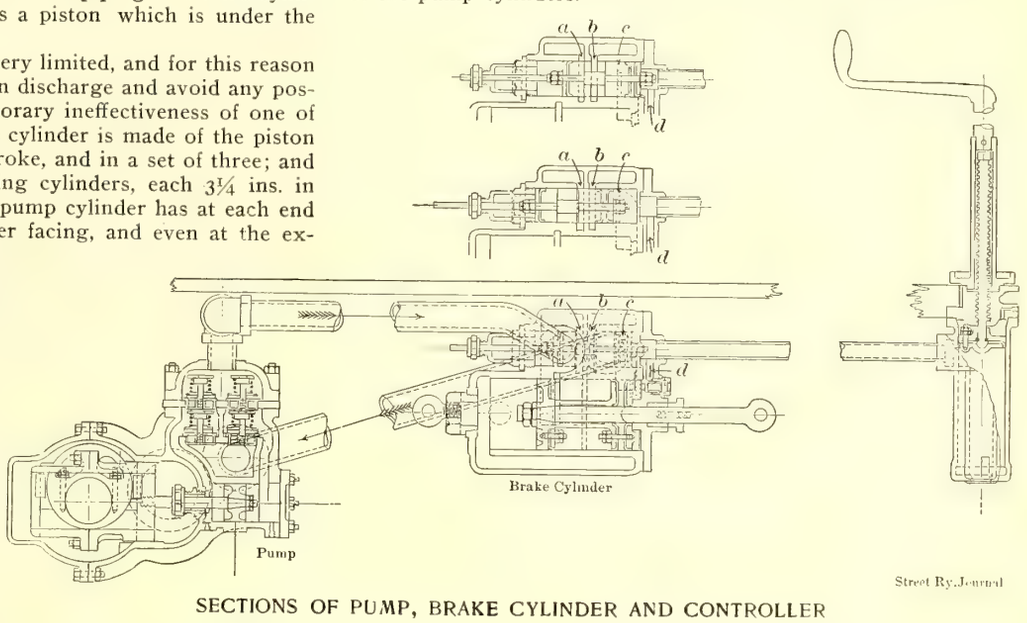
DIAGRAM SHOWING ARRANGEMENT OF BRAKE

Before mentioning the advantages claimed for this new brake, it will be well to refer to the drawings here given, and to give a description of it first.

The device consists essentially of a pump, or set of pumps, placed underneath the car platform, and operated continually by one of the car axles, to which they are attached. These pumps discharge into another cylinder, which actuates the brakes. The latter, called the brake cylinder, is connected by flexible piping to a third cylinder called the controller which has a piston which is under the direct control of the motorman.

The space underneath the car is very limited, and for this reason and also in order to get a more even discharge and avoid any possible trouble arising from the temporary ineffectiveness of one of the valves or other parts, the pump cylinder is made of the piston type—small in diameter, of short stroke, and in a set of three; and hence consists of three double-acting cylinders, each 3¼ ins. in diameter and 2½-in. stroke. Each pump cylinder has at each end one 2¾-in. metal valve, with leather facing, and even at the extremely high speed of 280 r. p. m., which corresponds to a car speed of 25 miles per hour, the velocity of the fluid through the valve seats is not excessive.

When the brakes are off, there is no pressure in the pump cylinders except that due to the friction of the fluid in passing through the valve seats and pipes; and for this reason the latter are also made large so as to reduce this friction to a minimum. When, however, the brakes are put on, the pressure rises perhaps 50 lbs., but the pump cylinders are made strong enough for 100 lbs. or more.



SECTIONS OF PUMP, BRAKE CYLINDER AND CONTROLLER

By reason of the same lack of room as mentioned before, there is not length enough under the car to operate the pump pistons by the usual crank, connecting rod and cross-head, and therefore the action is obtained by means of an eccentric of hard steel secured to the axle and pressing on slides, also of hard steel or bronze, which work in a cross-head, fastened to the piston rod; the whole being immersed in ordinary lubricating oil and contained in a closed tank.

To avoid freezing in cold weather, the working fluid selected is also oil, and a very limpid and white variety has been secured—free from any risk of fire.

From the pumps the oil passes into the brake cylinder, which is the effective part of the whole device, and consists of a lower cylinder, suspended to the bottom of the car by links and containing the brake pistons, and an upper cylinder containing a piston valve. The lower cylinder has two leather-packed pistons, one of which is connected to one brake rod, the other brake rod being fastened to the opposite end of the cylinder itself. The second, or loose piston so-called, is free, and in the ordinary action of the brake is inoperative, being held against the cylinder head by the pressure on the opposite face of this piston.

The brake cylinder has a port in about the middle of its length and extending half way around its circumference, and when the brakes are put on in the regular way, the oil, under pressure, comes in through this port and moves the brake piston, and so brings the brake shoes against the wheels by means of the same levers and rods as are now used in the ordinary hand-brake.

If, however, any accident happens to the pump and the brake piston fails to act, the motorman can force oil from the controller between the loose piston and the cylinder head, in a way to be hereafter described, and so bring the loose piston against the brake piston and put on the brakes by hand.

When the brakes are off the oil from the pumps does not enter the brake cylinder at all, but goes into the upper cylinder instead by one port and passes out of the same by another port, and so goes back to the pump. The upper or valve cylinder has really four ports, viz.:

1. In or about the middle of its length an entrance port *a* from the pump cylinder.

2. At one end an outlet port *c* leading into the brake cylinder between the cylinder head and the loose piston.

3. Between these two an outlet port *b* leading back to the suction of the pump cylinders.

4. In the cylinder head a port *d*, controlled by a check valve, which permits the passage of oil in one direction only. By this port, after the brakes have been put on by hand, the oil is brought back from the brake cylinder to the controller.

When the brakes are off, *a* and *b* are open and *c* is closed. When, on the other hand, the brakes are to be put on in the regular way, *a* is still open, but *b* is partly or wholly closed, *c* also being still closed. Oil is then forced by the axle-pumps into the brake cylinder and pressure is brought on to the fixed piston to move the brakes. If, however, for any reason, the pumps do not act, the motorman can move the piston valve over far enough to open *c*, *a* being still wholly or partly open and *b* still closed. He can thus force oil between the loose piston and the cylinder head and put the brake on by hand in this way, as before stated.

On the other hand, if any accident happens to the controller, or all the oil leaks out of the same, the valve cylinder is provided with a spring, which will force the piston valve back so as to close the port *a*, and the pumps will then force oil into the brake cylinder, and so move the fixed piston, and, in this way again, the car will be stopped automatically.

If for any reason the regular method of putting on the brake is only partially effective, the motorman can assist it more or less

by the hand-power. There are, in fact, four ways of applying the brake without recourse to anything except the single handle or lever in the grasp of the motorman.

1. The regular method, which requires only about one-eighth of a turn of the brake handle.

2. The direct hand-power method, which requires not over four turns of the brake handle to obtain the whole stroke of brake piston, and is likely to be used but rarely, if ever.

3. A combination of the first method with the second to a slight degree.

4. The safety method, which is instantaneous and also of very improbable occurrence.

The controller consists simply of a single-acting cylinder filled with oil and containing a piston fastened to the same rod to which the brake handle is attached. By means of the oil the motorman has a direct connection with the piston valve, and can move the latter, as before mentioned. The parts are so proportioned that the motorman has to exert a force of about 25 lbs. only on the brake handle in order to apply the brake by hand with a force of 50 lbs. per square inch on the brake piston; and in doing this he will have to take not over four turns of the brake handle to obtain the whole stroke of the brake piston; while it will take only one-eighth of a turn to close port *b* and put on the brake in the regular way, as before stated; and this with 5 lbs. only on the brake handle.

The principal advantages claimed for this brake are: The wheels are automatically kept from skidding, thus securing the maximum braking power. As soon as the wheels begin to skid the axle pumps will stop. Oil will then leak out of the brake cylinder through *b* into a reservoir provided. The pressure on the brake shoes will thus be reduced and the wheels started again by the momentum of the car; hence the pumps will start again, and pressure again be brought upon the brake blocks. So long, therefore, as the car moves at all, there will be a pressure upon the brakes.

If the pumps should fail to act, the motorman is still able to apply the brake by exerting his own strength on the brake handle in a way similar to and no more difficult than the present one.

If anything happens to the brake controller, so that the motorman has no command at all over the brake, the latter will be put on automatically and the car can be brought to a stop.

The mechanical and hand-power methods of working the brake are both operated by means of the same hand lever, so that in case of an emergency the motorman is not compelled to turn from his usual appliance to an unaccustomed one in order to stop the car.

The brake can be operated in four different ways, as stated above, and from either end of the car, so that, if the brake controller mechanism gives out at one end, that end can be shut off, leaving the car to be stopped from the other end.

It costs nothing to operate the brake, since there is practically no load on the pumps when the brakes are off, and when they are on the momentum of the car does the work of stopping it.

Test of an "L Special" Truck

A careful test of a Peckham "Elevated Special" double truck was made at the works of the Peckham Motor Truck & Wheel Company, Kingston, N. Y., on June 23, under the supervision of J. F. Morrison, superintendent and engineer of the South Side Elevated Railroad Company, Chicago, Ill.

The test made was of one truck frame, and resulted as follows:

Power applied,	20	tons,	1-8	in. deflection.
" "	30	"	3-16	in. "
" "	35	"	1-4	in. "
" "	40	"	7-16	in. "
" "	45	"	5-8	in. "
" "	50	"	15-16	in. "
" "	55	"	broke in yoke.	

Upon examination of the yoke it was found to be uniformly malleableized throughout, and contained no flaws.

The above test applied to one-side frames would be equivalent to a breaking strain of 110 tons for two-side frames used in the construction of each truck, or 220 tons for one car equipment of two trucks. This test shows that the trucks will safely carry from eight to ten times the maximum weight of the car and load for which they were designed.

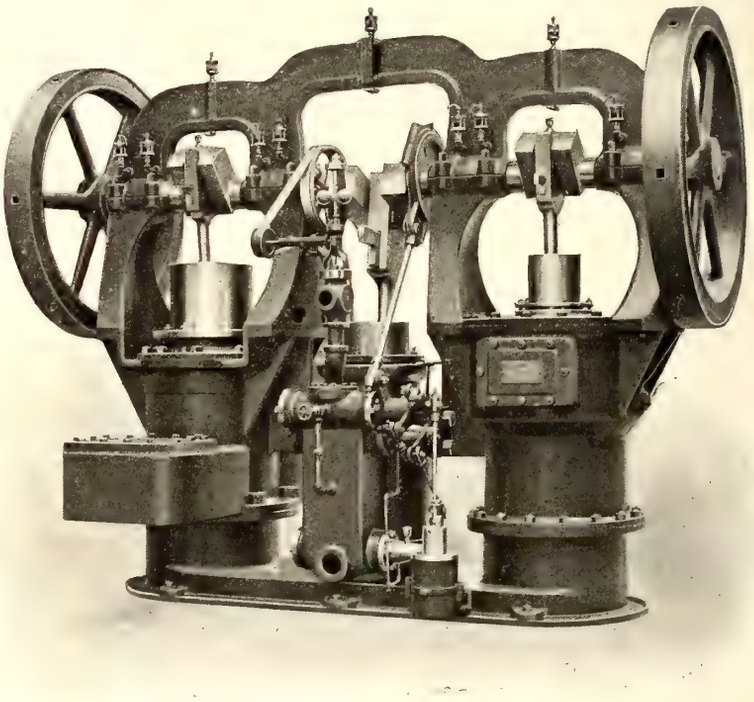
Consolidation of Supply Companies

The charter of the Miller-Knoblock Company, South Bend, Ind., being about to expire, the company has reorganized under the name of the Miller-Knoblock Electric Manufacturing Company, and will continue to make and sell commutators and armature coils.

The company has also consolidated with the Northwestern Electric Manufacturing Company, of Chicago, makers of insulated wire and the plant of the latter company has been moved to South Bend and installed in the commodious plant of the old Miller-Knoblock Company. The new company will, therefore, also produce all sizes of silk and cotton-covered magnet wire, and will make a specialty of coarse sizes of single and double cotton-covered wire for armature winding and field coils.

Combined Air and Circulating Pump

A description was published in the last monthly issue of this paper of the new combined air and circulating pump, recently brought out by the Conover Manufacturing Company, of New York. The accompanying engraving shows a general view of this pump, from which, with the sectional views published last month, a good idea of the arrangement of the various parts can be secured.



COMBINED AIR AND CIRCULATING PUMP

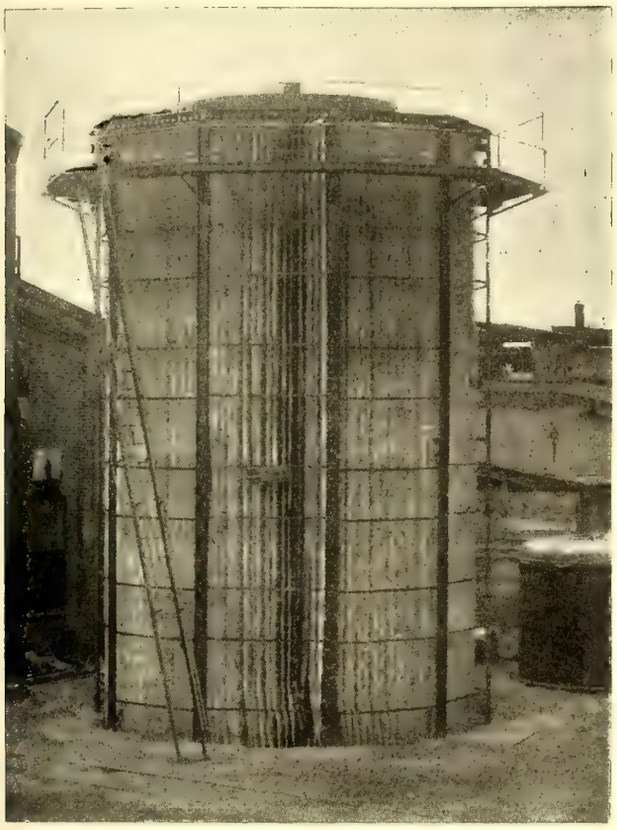
Electric Headlights

The use of electric headlights is growing so rapidly that the accompanying engraving showing the standard type of electric headlight, manufactured by the Dressel Railway Lamp Works, of New York, is of interest. This headlight is made of malleable iron, and is arranged to screw to the front of the dash, in which no hole cutting is necessary. The frame is so designed that the lamp can be easily cleaned or replaced, and is generally furnished with an 8-in. reflector, although it can be supplied with a 10-in. reflector if desired.

The Dressel Railway Lamp Works are one of the oldest manufacturing plants in this country, and have done a very large business in the steam railway field. The locomotive headlights made by this company are very extensively used, and many have adopted the headlight cases as their standard in connection with the Pyle National Electric Equipment. The Dressel Company manufactures nearly all varieties of headlights, signal lights and electroliers used by street railways, and has enjoyed an extensive reputation for the superior quality of its headlights, of which it makes a full line for both electric and kerosene service.

Fanless Cooling Tower

The wide adoption of cooling towers for condensing at points where a large supply of cool water is not available for this purpose has induced the Wheeler Condenser & Engineering Company, of New York, to give special study to the question whether a tower of this kind could not be devised to operate without an artificial draft. As a result of a long series of experiments, the company has finally



FANLESS COOLING TOWER

brought out the tower illustrated herewith, which is capable of giving practically the same result, without motive power, as the company's well-known Barnard inclosed fan-driven system.

The principle involved is the same as in the Barnard inclosed tower (which has been described in these columns), having the same wire cloth mats on which the water to be cooled is sprayed by means of perforated and slotted pipes. The outside shell, peculiar to the fan tower, has been entirely removed, thus leaving the mats exposed to the atmosphere on all sides. The tower is circular in form, with the mats radiating from the center; this arrangements utilizes all the natural air currents, and also those established within the tower itself.

All the mechanical means necessary to circulate air for cooling the water have been dispensed with, thus avoiding wear and tear—always associated with moving or operating parts. The great advantage of this type of tower is the absence of any motive-power requirements, which in turn increases the economy, as well as the general efficiency of the condensing plant.

The water distribution system is so designed that when a varying load is encountered, such as the operating day and night conditions of an electric station, one or more sections of the tower may be shut off. This feature is especially valuable, as any portion may be cut out and repaired or cleansed without interrupting the operation of the balance of the tower.

A gallery surrounds the upper works to facilitate inspection and cleaning when required, every portion of the water distribution system is accessible, and can easily be cleared of foreign matter.

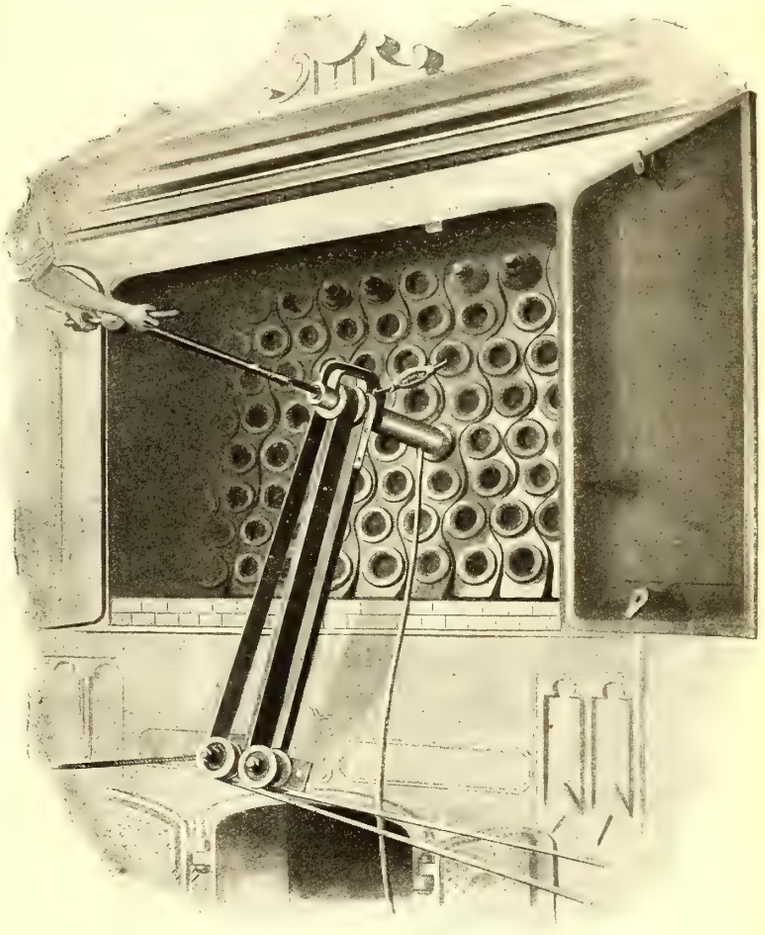
Particular attention has been given to the bracing of the whole structure, to provide against strains or exposure to wind pressures, all parts being of ample dimensions to insure great strength and durability. The fact that the average height of the tower is but 30 ft. recommends itself, especially when the tower must be located upon a roof structure, or in localities subject to high winds. When considering the question of a roof tower, it will be found that the weight per square foot of roof area is very low.

In extreme cases, such as great reductions in temperatures, or with very limited space, the company still recommends the Barnard inclosed fan tower, of which there is some 250,000 hp in use. The tower illustrated has a capacity of about 1000 hp.

Economy in Boiler Cleaning

The Weiland boiler tube cleaner, which is made by the Lagonda Manufacturing Company, of Springfield, Ohio, has been adopted in a number of steam plants with excellent results. A view of the cleaner is shown herewith, and illustrates very clearly the extremely simple manner of attaching and removing it from tube to tube or from one row of tubes to another. The machine itself is driven by either an electric motor, steam, gas or gasoline engine or any suitable power, and the manufacturers recommend about 5 hp, although they have driven it successfully with a 3-hp motor.

In preparing for its use it is only necessary to open the doors and remove the caps from the tubes, as with any cleaner. A platform is built in front of the boiler on which the operator stands. Attached to the cleaner is a swinging board with flange pulleys,



BOILER CLEANER

over which the belt runs, fitted to the bottom of it, and the belt, when the machine is in motion, is held tight. This board swings perfectly free, and it can be drawn down so that the belt is securely tightened when the machine is in motion, and loosened again when the operator desires to change from one tube to another. One man can readily handle it, and the time saved in getting ready to clean boilers is as much almost as is required in cleaning with some other devices.

A series of effective cleaner heads are used, by means of which the scale can be quickly and thoroughly removed from all the tubes, and the manufacturers state they are willing to undertake to remove with this machine the very heaviest scale that can be found in any water-tube boilers, having recently done very successful and satisfactory cleaning where the scale was so thick that only about 1 in. of opening remained. These machines are sold direct to users, or the manufacturers will take contracts for cleaning boilers of any style.

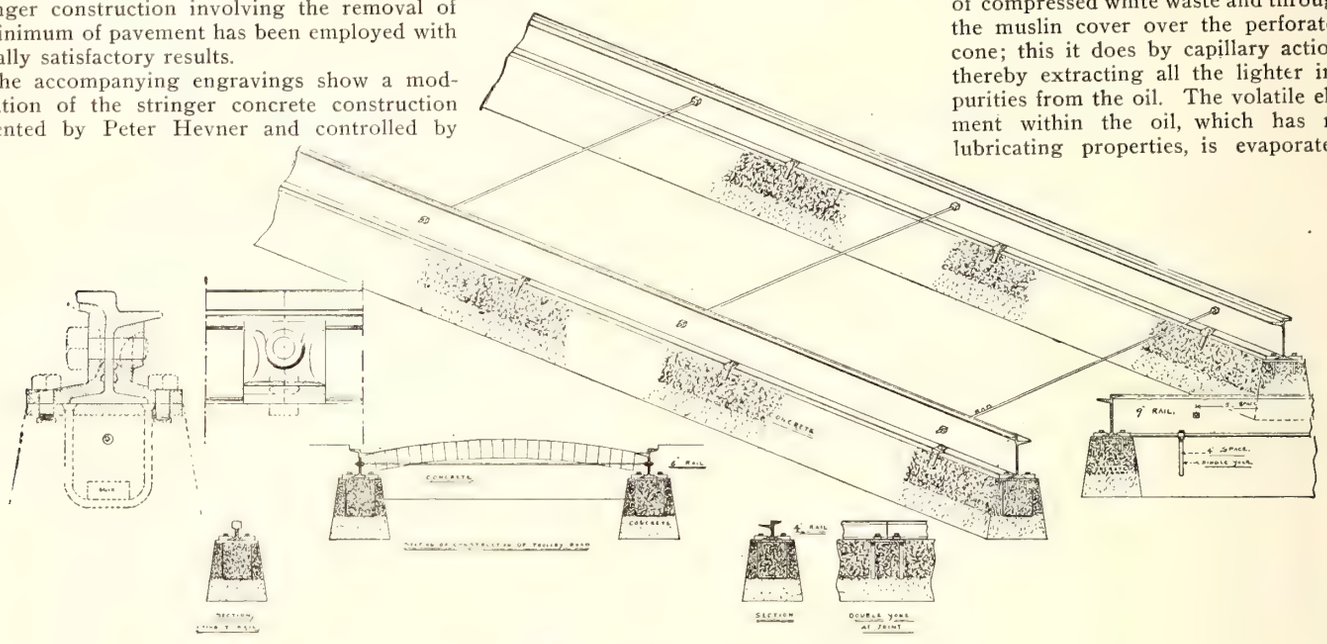
The Meriden, Southington & Compounce Tramway Company, of Meriden, Conn., has recently published a tasteful pamphlet containing views and descriptions of some of the most interesting points along its picturesque line.

Concrete Stringer Construction

The use of concrete without ties in track construction is one of the radical changes in that department of street railway work which have been accomplished since the introduction of electric traction. Concrete sub-construction has been adopted by railways in many of the principal cities of this country, and has proved perfectly satisfactory. In some cases, as is well known, the concrete is carried entirely across the roadbed, but in other cases a stringer construction involving the removal of a minimum of pavement has been employed with equally satisfactory results.

The accompanying engravings show a modification of the stringer concrete construction invented by Peter Hevner and controlled by the Indestructible Roadbed Company, of Philadelphia. As will be seen, the rails rest directly on a concrete prism, the depth of which depends upon the weight of rail, traffic to be carried, etc., and which can be laid in a narrow trench without interfering with the rest of the roadway. The rails are held to gage by tie rods every 4 ft. to 5 ft., as usual. The characteristic feature of the system, however, consists in the employment of U-shaped bolts, which are buried in the concrete when the latter is tamped in the trench, and are fitted with clips which fit over the base of the rail, holding the latter in position. The advantages of this construction over the ordinary construction in which the rail is set in concrete is claimed to be that it is much more easy to replace the rails. To do this it is necessary only to remove the nuts from the ends of the bolts and take out the tie rods, after which the rail can be replaced by an unworn section. The construction has been employed in Syracuse and elsewhere.

If desired, feeder conduits can be laid in the concrete stringer, which is usually 9 ins. wide on top, 13 ins. deep, and 13 ins. in width at the base.



CONCRETE STRINGER CONSTRUCTION

The Famous Oil Purifier

The rights to the Famous oil purifier, which has been employed in many power stations, have recently been secured by the Chicago Boiler Cleaner Company, of Chicago, which is now placing this device on the market. The filter is illustrated in section herewith, and depends for its operation on the use of a low initial heat by means of the air jacket and steam jacket combination embodied in this apparatus.

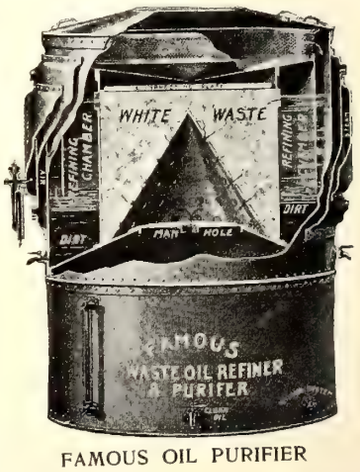
Exhaust or live steam is admitted into the steam jacket at the left-hand side, see engraving. The amount of steam admission is regulated by a globe valve placed in the inlet pipe in a convenient position close to the apparatus. In the drain or outlet of the steam jacket is interposed a water trap, to check the outflow, to insure a positive filling of the steam jacket with steam in the most economical manner. The relief valve prevents injury to the jacket by over pressure, as it opens at less than 1-lb. pressure.

The dirty waste oil is poured or led into the removable strainer, which retains all the coarser impurities; the oil then passes through the large area of fine straining surface (around the removable strainer), then down toward the bottom of the settling and refining chamber; the unsettled oil is always kept away from the filtering material by the deflecting shield which hangs in this chamber.

The proper waste oil refining and purifying temperature is safely and gradually communicated to the oil in the refining chamber by the steam jacket through the air jacket, thereby thinning the oil and making it bright and clear, and all the entrained water, carbon and suspended impurities are separated from the oil and precipitated on the bottom of the settling chamber, when they are readily withdrawn through the dirt faucets. In this manner the waste oil is first thoroughly strained, then positively settled and refined, and fully 90 per cent, it is claimed, of the impurities are extracted from the oil before it overflows into the filtering chamber. The oil then gradually filters through the large area of compressed white waste and through the muslin cover over the perforated cone; this it does by capillary action, thereby extracting all the lighter impurities from the oil. The volatile element within the oil, which has no lubricating properties, is evaporated, thereby refining the oil and making it a higher grade lubricant.

In the jacket system embodied in the Famous the settled and precipitated impurities are not stirred up by circulation, as no heat is applied under, or even near, the bottom.

As the cubic contents of the refining chamber are comparatively small, on account of the displacement by the filtering chamber, and also because the jacket prevents radiation, the initial heat communicated to the dirty oil by the extra large area of low heating surface presented by the jacket is so low that the proper refining and purifying temperature is obtained without injury to the lubricating properities of even the lowest grade of oil, and regardless of cold and hot-water changes.



FAMOUS OIL PURIFIER

The perforated cone presents a large area of filtering surface. The purified oil is delivered cold at the clean oil faucet.

Lifting out the removable strainer by the handles opens the entire refining chamber and filtering chamber, and the filtering material may be inspected or renewed without drawing off any oil or disturbing any part of the apparatus. The straining surface being placed around the side, and not on the bottom of the removable strainer, prevents clogging by the heavy and coarse impurities.

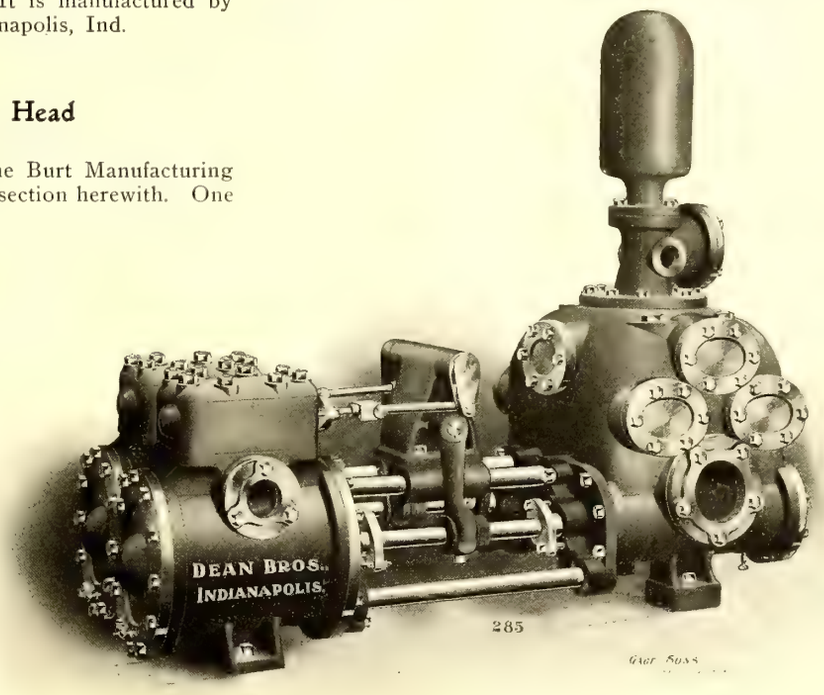
For use where steam is not available, as in rotary sub-stations, a modified form of filter is manufactured, in which the heat is secured by means of electricity. The Chicago Boiler Cleaner Company also supplies, without charge, an oil microscope by which the engineer can determine for himself whether the oil he is using is free from impurities or not.

A meeting of the stockholders of the Cleveland Electric Railway Company will be held on Aug. 9, when a proposition to increase the capital stock of the company from $12,000,000 to $13,000,000 will be voted upon.

A Modern Duplex Pump

The duplex pump has been in use so long that its principles are well understood by most engineers. The accompanying engraving shows the latest development of this type of pumps for heavy pressure and hard service. As will be seen, the steam cylinders and steam chests are heavy and strongly bolted. The frame is made with heavy polished steel stretcher rods. The water cylinders are extra heavy, and are cast in one piece. The hand-holes are large and valves are of moderate size.

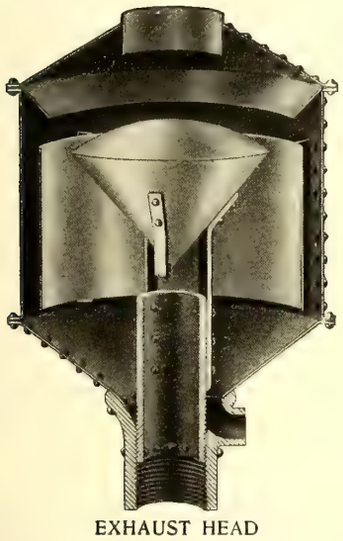
By skillful designing and careful workmanship a pump has been produced that will run under heavy pressure for a long period of time without repairs. The pump shown has 12-in. steam cylinders, 7-in. water cylinders, and 10-in. stroke. It is manufactured by Dean Bros. Steam Pump Works, of Indianapolis, Ind.



DUPLEX PUMP

New Type of Exhaust Head

A new type of exhaust head, built by the Burt Manufacturing Company, of Akron, Ohio, is illustrated in section herewith. One



EXHAUST HEAD

chief feature of the head is the absence of baffle plates. The exhaust steam, after coming in through the pipe, strikes the cone immediately over the inlet. This cone separates the steam into fine particles, condensing some of the vapor. The greater volume of steam rises up to the small projection extending around the top of the head, and is held there for an instant, causing the particles of water and oil to drop by force of gravity down between the double walls on the side and out through the drip below. The use of perpendicular sides gives the maximum cooling surface for the exhaust steam, while nothing but dry steam escapes from the outlet.

The Burt exhaust head is made from extra heavy iron, lapped and riveted.

Convenient Curtain Holder

The Quaker City Car Curtain Supply Company, Ltd., of Philadelphia, has recently brought out a new pinch-handle cable holder for car curtains, which is illustrated herewith, and which is called the Victor holder. The chief claims made for the holder are that it holds the cable tightly and does not slip up, and that it does not wear out. The handle is very easily operated and kept in repair.

The Quaker City Car Curtain Supply Company is a new corporation, having been incorporated May 31, 1900, with Benjamin Conner as president, A. G. Shellenberger as secretary and treasurer, and William Daut as general manager. The company also manufactures curtains of all descriptions.

An Improved Fare Register

The accompanying illustration gives a general view of a register which has lately been designed. It is claimed for this register that it not only contains all the advantages found in similar appliances, together with many more that are peculiarly its own, but that it can be supplied to railway companies at a cost much below the present price of first-class registers. It has been called the "Monarch," and is made both single and double. The appearance of the round bronze case is handsome, and the workmanship of the mechanism within is of the best, although a specially designed bolt prevents the inspection of this latter feature by anyone but the proper authorities. Various ingenious interlocking devices in the trip-register mechanism prevent tampering with the number of fares already rung up, and a perfected "flag" device and catch prevent the bell from ringing except when both trip register and totalizer record. In the double form each register is independent, there being two separate bells of different tone. The case of the double is the same size as the single. Both trip registers count up to 1000 and the totalizer to 100,000. No seal is

NEW FARE REGISTER

used on the case, as the precautions taken to prevent opening, turning back or in any way tampering with the mechanism have been thought sufficient guard against theft. The manufacturers of this new register are Neilsen & Bentson, New York. A. E. Neilsen, of the firm, has had many years' experience with some of the best makers of fare registers in the country, and is, therefore,

able to employ the very best practise in making the Monarch. The Morris Electric Company, 15 Cortlandt Street, New York, controls the device, which is sold only through that company.

The New Works of the Jewett Car Co.

The Jewett Car Company, on March 1, 1900, moved from Jewett to Newark, Ohio, where the company has now almost completed the erection of one of the largest street car manufacturing plants in this country. The buildings and yards are shown on the accompanying diagram, and cover about 10 acres of ground. Seven large buildings are now completed, and a drying kiln and a number of smaller buildings are under construction.

A side track from the Baltimore & Ohio and P. C. C. & St. L. railroads brings lumber to the yards, and gives the best facilities for making shipments of finished cars. At the west of the side track where the car timber is unloaded, is now being erected a very large drying kiln 40 ft. x 100 ft., and near this, on the opposite side of the track, stands a large building for storing dry lumber. Near the dry-lumber building is the machine shop, which is built in "U" shape, fronting 136 ft. on the transfer track. The south wing running back 176 ft. x 48 ft. wide, is equipped with modern heavy car-building machinery. This part of the machine shop is used principally for the heavy work. The north wing extends back 144 ft. x 48 ft., and is equipped with the most modern machinery for getting out interior finish. The rear end of this wing is used as a cabinet room.

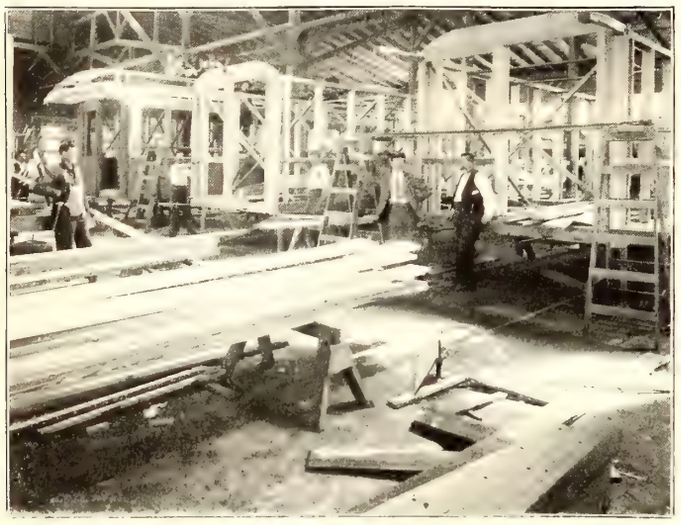
It will be noted that the above arrangement is such as to facilitate the handling of material. Cabinet work is in these departments prepared complete for erection. Between the two wings of this building is a dry kiln used for drying lumber for interior finish. This arrangement brings the finished lumber the nearest possible to the point where it is worked up.

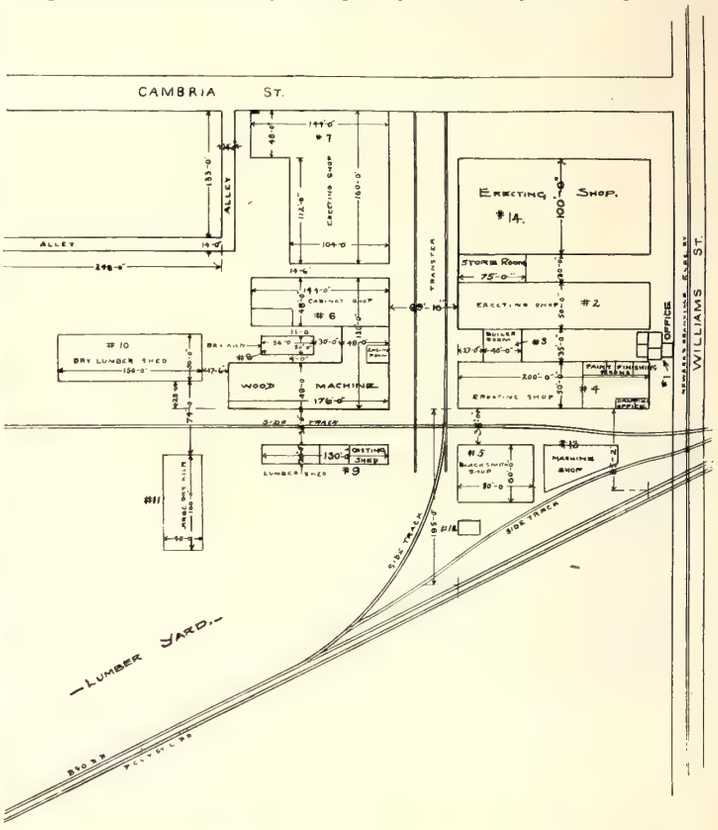
North and in line with the machine and cabinet shop is one of the erecting shops 160 ft. x 104 ft. with a wing 48 ft. square. This building has ten tracks laid in a cement floor. Here the cars are erected and painted ready for varnishing.

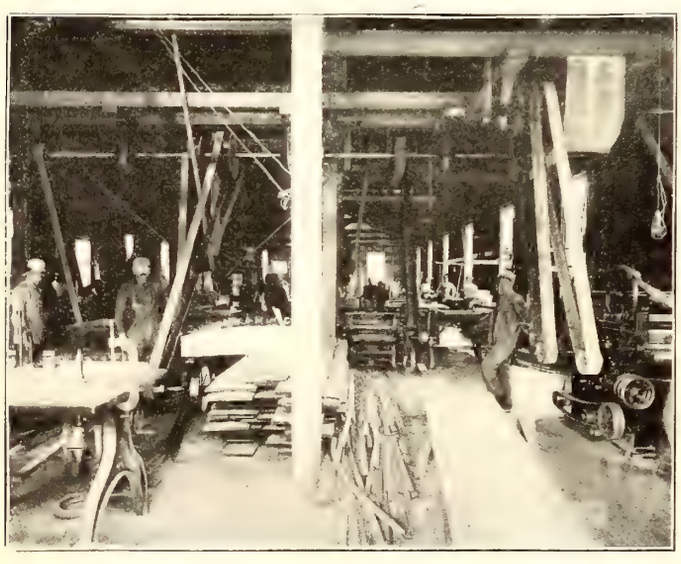
Along the front of the buildings named runs a 70-ft. electric transfer table, which is equipped with electric motor, and so arranged that cars are easily and quickly handled by electric power, either from one department to another or on to trains for shipment. Connecting with the transfer table on the east are two brick buildings, each of which is 50 ft. x 200 ft., roofed with slate. The north brick building is equipped with tracks and has a cement floor, making it practically dust-proof. The cars are transferred into this building for finishing and varnishing.

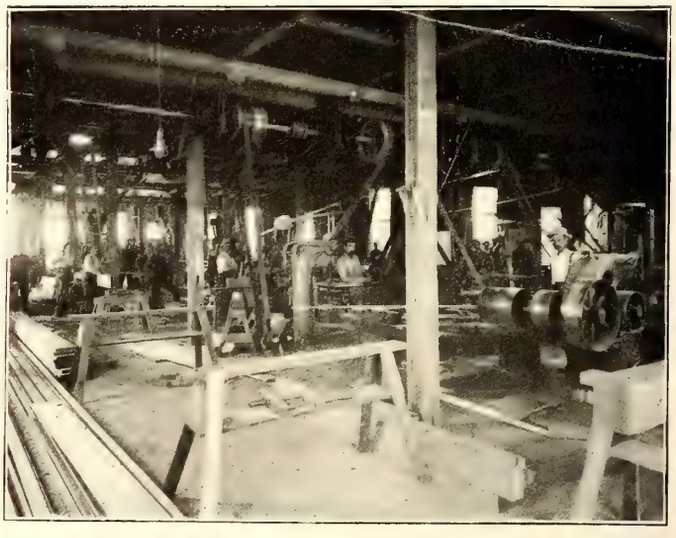
The south brick building is partitioned, half being used for a varnish room, where head linings, sash, etc., are finished. The remaining half of this building, being directly across from the machine shop where the body material is milled out, the lighter parts of the body material are taken to this department to be cleaned up, assembled and stored ready for transferring to the different erecting shops as needed.

At the northeast corner of one of the last-named shops is the









PLAN OF WORKS AND VIEWS IN THE SHOPS OF THE JEWETT CAR CO.

building used for storing bronze trimmings, screws, bolts, nails and other hardware for use in the construction of cars.

Plans are now being completed for another large erecting shop 100 ft. x 200 ft. This will be constructed of pressed brick, with self-supporting roof, covered with slate; it will have seven tracks; four of these will have pits for mounting motors and equipping cars ready for service. This shop will be equipped with an overhead traveling crane.

To the south of the buildings last named is the blacksmith shop 60 ft. x 80 ft., and there is now in course of construction an addition to be used for machinery purposes.

These buildings are so situated, being surrounded by three side tracks, as to make easy the handling and unloading of heavy material from the cars. The blacksmith and machine shop are equipped with the latest improved machinery, such as steam hammers, punches, shears, drill presses, bull dozers, bolt machines, lathes, forges, blowers, traveling crane, and pneumatic hoists.

The plant is complete in every respect. The shops are lighted throughout with electricity, and a complete system of water mains and sewers is now going in, affording ample fire protection, etc. The lumber yards and general yards are equipped with tracks and turn-tables to facilitate the handling of lumber.

The Jewett Car Company has long had an enviable reputation for turning out one of the best-built cars on the market. Now that its plant has grown to be one of the largest in the country, this reputation, backed by the facilities for turning out large orders rapidly, will be of great value. The symmetrical outlines of the company's cars, as illustrated herewith, will suggest to the reader the modeling after steam-coach designs.

The JOURNAL's correspondent found the company's shops crowded with work. Some 400 men are employed, and the force is rapidly being increased.

Among the orders on hand are thirty cars for the Alley L in Chicago, cars for the Steubenville, Mingo & Ohio Valley Traction Company; for Wichita, Kan.; Cincinnati, Lawrenceburg & Aurora; Detroit, Monroe & Toledo; Buffalo & Hamburg, and elsewhere.

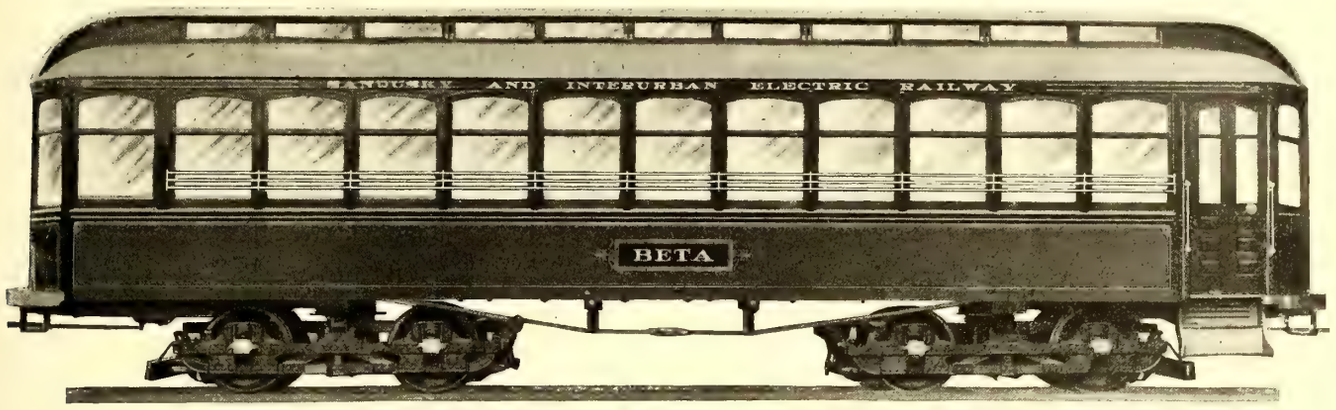
The officers of the Jewett Car Company are: W. S. Wright, president, Wheeling, W. Va.; H. S. Sands, secretary, Wheeling, W. Va.; A. H. Sisson, manager and treasurer; Neil Paulson, superintendent.

Large New Car Wheel Works

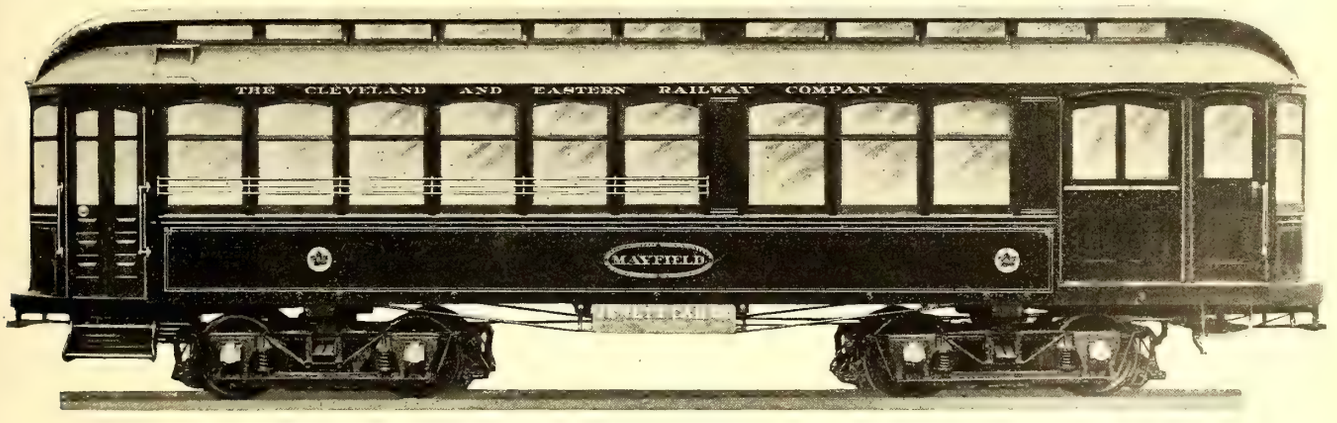
The Keystone Car Wheel Company has been incorporated under most promising conditions, and the works are now in process of construction. The capital of the company is $200,000, and the proposed plant will have a capacity of from 300 to 350 wheels per day. Extensions to the plant, however, can be made with little inconvenience and moderate outlay, as it is confidently expected that the output will soon reach 600 wheels a day. The present plans provide for a foundry and shop containing all the modern labor-saving devices, such as pneumatic hoists, automatic carriers, etc., to be erected near Homestead, Pa. The company has bought an exceptionally fine site of 10 acres on the Monongahela river adjoining the new works of the Haribson-Walker Company. The railroad facilities are extremely good, direct connection being had with the Baltimore & Ohio, Pittsburgh & Lake Erie, Pittsburgh, Virginia & Charleston, and the Union Terminal of the Pittsburg, Bessemer & Lake Erie Railroad. The works will also be within convenient distance of electric lines to Pittsburgh. The main building will be of brick 300 ft. long by 110 ft. wide, so arranged that longitudinal extensions may be made by merely removing the end walls.

The organizers and directors of the company are: Charles V. Slocum, formerly treasurer and manager of the Pennsylvania Car Wheel Company; William L. Elkins, assistant treasurer of the Consolidated Traction Company, Pittsburgh; William W. Lobdell, president of the Lobdell Car Wheel Company, of Wilmington, Del.; Louis B. Whitney, formerly of A. Whitney & Sons, of Philadelphia, the oldest car wheel manufacturers in the United States; Charles A. Otis, Jr., of Otis, Hough & Co., iron and steel merchants, of Cleveland, and son of the former president of the Otis Steel Company.

The officers are: President and general manager, Charles V. Slocum; vice-president, William W. Lobdell; treasurer, Louis B. Whitney, and secretary, John Howard Yardley, formerly vice-president of the Philadelphia Car Wheel Company and one of the organizers of the Pennsylvania Car Wheel Company. The new company has first-class financial backing, and its technical strength is assured by the personnel of the organization. The very best work will be turned out for both steam and electric



LONG CAR FOR SANDUSKY AND INTERURBAN RAILWAY CO.

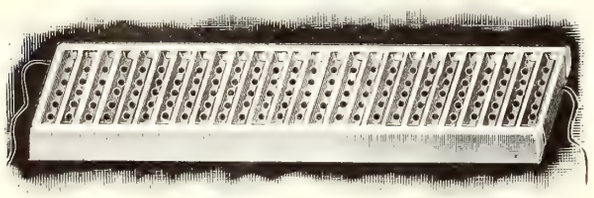


LONG CAR FOR CLEVELAND AND EASTERN ELECTRIC RAILWAY CO.

service, but a specialty will be made of street railway car wheels. President Slocum has always had remarkable success in the car-wheel business. At twenty-five he was business manager for Frederick Stearns & Company, Detroit, leaving that position to become treasurer of the New York Car Wheel Company, Buffalo. He resigned in 1898 to take an active part in the organization of the Pennsylvania Car Wheel Company, with which company he remained until last November. His brother, A. W. Slocum, who has been associated with him in most of his car-wheel ventures, will probably be connected with the new company.

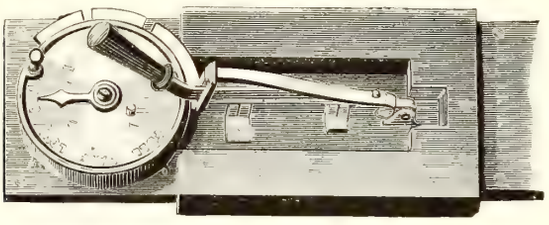
Electric Car Heaters

About this time of year the managers of street railways are looking around for an economical car heater. The National heater, the plate of which is illustrated on this page, is constructed on practical principles, and the manufacturers claim that, although it has a large radiating surface, the space occupied is a minimum.



FRAME OF HEATER

It is made from sheet iron, corrugated, and then heavily coated with white enamel. This assures perfect insulation and prevents deterioration. The heating resistance being imbedded in the enamel, it cannot corrode, or break and ground the heater. The wires are safe from mechanical strain, and as it takes the heater about thirty minutes to cool off after breaking the circuit they are practically under a process of annealing during that period. The



REGULATING SWITCH

heaters are made by the National Electrical Manufacturing Company, which also makes the regulating switch shown in the second cut. This device has a capacity of 25 amps. at 650 volts, and will allow three different degrees of heat to be obtained. Arrangements are made to prevent the operator receiving a shock, and a locking system prevents the changing of the dial until the switch is opened. Both of these specialties are being placed on the market by the Morris Electric Company, New York.

The American Bridge Company

The American Bridge Company has issued the following circular letter to the trade: "As a result of numerous conferences it has been deemed expedient to organize the American Bridge Company, incorporated for the purpose of designing, building and erecting bridges and all classes of metallic structures. The facilities at our disposal are such that we have every confidence that we shall be able to give you the advantage of very favorable quotations, and at the same time be enabled to avoid delays in delivery, which in the past have proved so vexatious in many instances. We solicit your inquiries, which shall have our very best attention."

Below will be found a list of the various bridge companies forming the consolidation, as follows:

American Bridge Works, Chicago, Ill.
Berlin Iron Bridge Company, East Berlin, Conn.
Buffalo Bridge & Iron Works, Buffalo, N. Y.
Carnegie Steel Company (Keystone plant), Pittsburgh, Pa.
Edge Moor Bridge Works, Wilmington, Del.
Elmira Bridge Company, Elmira, N. Y.
Gillette-Herzog Manufacturing Company, Minneapolis, Minn.
Groton Bridge & Manufacturing Company, Groton, N. Y.
Hilton Bridge Construction Company, Albany, N. Y.
Horseheads Bridge Company, Horseheads, N. Y.
Lafayette Bridge Company, Lafayette, Ind.
Lassig Bridge & Iron Works, Chicago, Ill.
New Jersey Steel & Iron Company, Trenton, N. J.
New Columbus Bridge Company, Columbus, Ohio.
Pittsburgh Bridge Company, Pittsburgh, Pa.
A. & P. Roberts Company (Pencoyd Iron Works), Pencoyd, Pa.
Post & McCord, Brooklyn, N. Y.
Rochester Bridge & Iron Works, Rochester, N. Y.
Schultz Bridge & Iron Works, Pittsburgh, Pa.
Shiffler Bridge & Iron Company, Pittsburgh, Pa.
Union Bridge Company, Athens, Pa.
Milwaukee Bridge Company, Milwaukee, Wis.
Wrought Iron Bridge Company, Canton, Ohio.
Youngstown Bridge Company, Youngstown, Ohio.

This list contains all the leading companies that manufacture bridge and structural work in this country, with the combined capacity of 600,000 tons per annum. The Pencoyd plant, of the A. & P. Roberts Company, also comprises one of the best and most complete rolling mills for structural material in existence, with a capacity of 200,000 tons per annum. This puts the American Bridge Company in a position to furnish all classes of bridge and structural work at an absolute minimum of cost, and in the very shortest possible time, and this has already been announced as the future policy of the company. No advance in prices will be made, but the cost of production will be reduced to an absolute minimum, and, judging from the known facilities of the various plants, the facts would seem to justify the statement.

The directors of the company are as follows: Percival Roberts, Jr., A. & P. Roberts Company (Pencoyd Iron Works),Pencoyd, Pa.; Alfred C. Case, Carnegie Steel Company, Pittsburgh, Pa.; William H. McCord, Post & McCord, Brooklyn, N. Y.; Charles M. Jarvis, Berlin Iron Bridge Company, East Berlin, Conn.; William H. Connell, Edge Moor Bridge Works, Wilmington, Del.;Walter Hawxhurst, Elmira Bridge Company, Elmira, N. Y.; Charles Macdonald, Union Bridge Company, Athens, Pa.; Frank Conger, Groton Bridge Company, Groton, N. Y.; James P. Kennedy, Youngstown Bridge Company, Youngstown, Ohio; Lewis S. Gillette, Gillette-Herzog Manufacturing Company, Minneapolis, Minn.; John F. Alden, Rochester Bridge & Iron Works, Rochester, N. Y.; Walter G. Oakman, Guarantee Trust Company, New York, N. Y.; J. P. Ord, General Electric Company, Schenectady, N. Y.; Robert Winsor, Kidder, Peabody & Co., Boston, Mass.; Robert Bacon, J. P. Morgan & Co., New York, N. Y.; Charles Steele, J. P. Morgan & Co., New York, N. Y.; Paul E. De Fere, 40 Wall Street, New York, N. Y.; Robert S. Green, 1 Montgomery Street, Jersey City, N. J.; J. W. Walker, Shiffler Bridge Company, Pittsburgh, Pa.; Abram S. Hewitt, Cooper, Hewitt & Co., New York, N. Y.; August Belmont, August Belmont & Co., New York, N. Y.

The majority of this board are practical bridge men who have in years past made a success of their individual companies. The financial end is unusually strong, being represented by firms and institutions of world-wide financial strength, thus forming a combination of practical and successful bridge men, backed by the strongest of financial resources.

The executive organization is made up entirely of men of large practical experience, headed by Percival Roberts, Jr., one of the leading rolling mill managers of the country. Joshua A. Hatfield has been appointed as assistant to the president, and will also have charge of the sales of the rolling mill products of the Pencoyd plant. The engineering department is in charge of Charles C. Schneider, formerly chief engineer of the Pencoyd Iron Works, of the A. & P. Roberts Company, with the title of vice-president, in charge of engineering.

The operating department is in charge of Charles M. Jarvis, formerly president of the Berlin Iron Bridge Company, with the title of vice-president, in charge of operating. As soon as contracts for any work are taken, they are immediately turned over to this department for execution, and consequently all the plants and erecting forces of the company belong in this department. At each plant is a manager, with full charge over all employees and the operations of that particular plant. All managers are under the direct charge of a general manager, James P. Kennedy, formerly president of the Youngstown Bridge Company. The erecting is also in charge of the operating department, and this is under William Wennas, as superintendent. Mr. Wennas has had full charge of all the Pencoyd erecting for a number of years, and gained a world-wide reputation but a short time ago for the economical and expeditious manner in which he handled the erection of the famous Atbara Bridge.

All the sales of the company are in charge of the contracting department. Railway contracting, highway contracting and structural contracting.

CURRENT NEWS

House Dynamited at St. Louis

A striker or strike sympathizers made a desperate attempt at dynamiting the house at 3750 Evans Avenue, St. Louis, on July 29. No. 3750 Evans Avenue and the adjoining house are conducted as boarding houses for Transit Company employees, and the object of the dynamite thrower was presumably to kill the occupants of the house, as the dastardly act was committed at 2 a. m. Both houses were badly damaged by the explosion, but fortunately none of the inmates was injured. This is one of the most brazen acts of the strike, and was very unexpected, as there have been no serious attempts at violence of late.

Hearing of the Suit of Sutro Brothers Against the Chicago Consolidated Traction Company Adjourned Until September

On July 27 the hearing of the suit instituted by Sutro Brothers, of New York, against the Chicago Consolidated Traction Company, seeking to force an accounting and a cancellation of the $6,750,000 mortgage given by the company on its property, was adjourned by agreement to the September term of the court. It was ordered that in the meantime there should be no transfer of the Chicago Consolidated Traction stock or any action taken effecting the transaction referred to in the bill of complaint.

Mr. Yerkes in London

C. T. Yerkes, of Chicago, has arrived in London, where he has gone to investigate the London transportation question at the request of an English syndicate, which holds franchises under past Parliamentary grants. D. H. Louderbach, of Chicago, representing Mr. Yerkes, is also in London. He arrived there several weeks before Mr. Yerkes, and has been studying the situation, in order to report on the outlook. Mr. Yerkes, in an interview, said: "If London desires a complete system of intramural traffic, I think we can give it. I have come here in an advisory capacity. It may be possible to establish a combination of underground lines in the city connecting with the surface lines outside, and thus afford the traffic facilities so much needed."

Massachusetts Electric Companies Absorb Another Road

At a special meeting of the stockholders of the Massachusetts Electric Companies, held July 30, it was voted to purchase the Lowell & Suburban Railroad and to ratify the purchase of the South Shore & Boston Railway. The basis of exchange of shares of the Lowell & Suburban was two shares preferred and 1½ common of Massachusetts Electric Companies' stock for one share of Lowell & Suburban Railroad. The basis of exchange of the South Shore & Boston was one share preferred and three-quarters of a share of common of Massachusetts Electric for each share of South Shore & Boston. It was also voted to pay the semi-annual dividends in July and January, instead of in June and December, as at present. President Gordon Abbott made the following statement: "The first fiscal year ends Sept. 30, and before the annual meeting on Nov. 7 a full report of the year's operations will be sent in to all the shareholders as follows: Gross earnings, $3,102,518, an increase of $293,053, or 10.4 per cent; operating expenses, $2,132,679, an increase of $44,781, or 2.14 per cent."

Chicago General Railway to the City on Municipal Ownership and Reduced Fares

On July 23, Charles L. Bonney, general counsel of the Chicago General Railway Company, laid before the Street Railway Commission a series of resolutions adopted by the directors of the company relating to the question of municipal ownership, and also to the specific condemnation of tracks owned and operated by the existing companies. One of the main features in Mr. Bonney's communication to the commission was a direct offer by his company to carry passengers between the Illinois Central Depot at Twelfth Street and the Chicago & Northwestern Depot at Wells Street, for 3 cents; also to carry trunks and packages for 20 cents each, on condition that the city authorities aid in securing permission for the Chicago General cars to run between the points named. Mr. Bonney is also authorized to secure legal adjudication of the right of his company to the use of the Chicago City Railway's tracks on Wabash Avenue, from Twenty-Second Street to Madison Street. General Counsel Bonney holds that by the ruling of the Supreme Court the exclusive right of any corporation to maintain ownership in the city's streets can be set aside at the behest of the people's law officers. The Chicago General's ultimate aim is to get terminal facilities in the downtown district.

Electrical Tramways in Barcelona

The United States State Department has received the following communication from Consul-General Lay, of Barcelona, regarding the electric tramways there:

"I give below the names of the directors and chief contractors of a tramway line about to be built between Barcelona and Horta, a distance of 4 miles. The name of the branch line will be the Barcelona & San Andres Railway, work to be commenced in June.

"Builders, Société Anonyme d'Entreprise Générale de Travaux at Liege, Belgium.

"President, Mr. Laloux.

"Director-General, Mr. Thouet.

"The chief contractor is F. H. Bagge, 14 Ronda Universidad, Barcelona, who imports his trucks, tubing for posts, and motors from the United States.

"The wire is to be supplied by Felten & Guilleaume, of Mulheim; rails, from Belgium; car motors, by General Electric Company, Paris; gas engines, Crossley, of Manchester; cars, from Saragossa, Spain; accumulators, Tudor; dynamos, Industrial Electrico, Barcelona.

"I find it very difficult to get any reliable information about projected roads, especially about those for which the equipment is being bought, as the directors, chief engineers and other officials of new tramways are foreigners, and have their headquarters in other cities. I would suggest, therefore, that our manufacturers write the Société Anonyme d'Entreprise Générale de Travaux, Liege, Belgium, in good time before the contracts are let at Brussels. The society is a very large one, and has built many miles of tramways in Europe, and is constructing lines in Russia, I understand, at the present time.

"In connection with the sale of electrical supplies and equipment in Barcelona, I would advise manufacturers of motors not used in connection with tramways and other small electrical appliances that their agents here must keep a certain stock of such articles on hand, as I am informed by several electrical importers of Barcelona that frequently English or German goods are sold because the purchaser cannot wait for better American-made articles, which take so long to come from the United States."

Report of the Interstate Commerce Commission

The Interstate Commerce Commission has just issued its twelfth annual report. This report gives some very interesting statistics of railways in the United States for the year ending June 30, 1899. From these statistics it seems that on June 30, 1899, the total single-track railway mileage in the United States was 189,294.66 miles, an increase during the year of 2,898.34 miles being shown. This increase is greater than for any other year since 1893. Practically all of the railway mileage of the country is covered by reports made to the Commission, the amount not covered being 1,759.98 miles, or 0.93 per cent of the total single-track mileage. The aggregate length of railway mileage, including tracks of all kinds, was 252,364.48 miles.

The number of railway corporations included in the report on the Statistics of Railways in the United States was 2049. Of this number, 1064 maintained operating accounts, 843 being classed as independent operating roads and 221 as subsidiary roads. The operated mileage of roads merged, reorganized, or consolidated during the year was 5846.35 miles. The corresponding figure for 1898 was 7220.42 miles.

EQUIPMENT

There were 36,703 locomotives in the service of the railways on June 30, 1899, or 469 more than the year previous. Of the total number reported, 9894 are classed as passenger locomotives, 20,728 as freight locomotives, 5480 as switching locomotives, and 601 are not classified.

The total number of cars of all classes in the service of the railways on June 30, 1899, was 1,375,916. Of the total number, 33,859

are assigned to the passenger service, 1,295,510 to the freight service, and 46,556 to the direct service of the railways. It should be understood, however, that cars owned by private companies and firms used by railways are not included in the returns made to the Commission. It appears that the railways of the United States used on the average 20 locomotives and 734 cars per 100 miles of line; that 52,878 passengers were carried, and 1,474,765 passenger-miles accomplished, per passenger locomotive; and that 46,303 tons of freight were carried, and 5,966,193 ton-miles accomplished, per freight locomotive. All of these items show an increase when compared with corresponding items for the preceding year ending June 30, 1898.

The number of persons employed by the railways of the United States, as reported on June 30, 1899, was 928,924, or an average of 495 employees per 100 miles of line. As compared with the number employed on June 30, 1898, there was an increase of 54,366, or 21 per 100 miles of line. From the classification of these employees it appears that there were 39,970 enginemen, 41,152 firemen, 28,232 conductors, and 69,497 other trainmen. There were 48,686 switchmen, flagmen and watchmen. The compensation of the employees of railways for 1899 represents 60 per cent of their operating expenses, and 40 per cent of their gross earnings.

The amount of railway capital outstanding on June 30, 1899, was $11,033,954,898. This amount assigned to a mileage basis represents a capitalization of $60,556 per mile of line. Of this amount of capital $5,515,011,726 existed in the form of stock, of which $4,323,300,969 was common stock and $1,191,710,757 preferred stock. The amount which existed in the form of funded debt was $5,518,943,172. This amount of funded debt was classified as mortgage bonds, $4,731,154,376; miscellaneous obligations, $485,781,695; income bonds, $260,048,753, and equipment trust obligations, $42,058,348. The amount of current liabilities not included in the foregoing capital statement was $554,330,022, or $3042 per mile of line.

The amount of capital stock paying no dividend was $3,275,509,181, or 59.39 per cent of the total amount outstanding. The amount of funded debt, excluding equipment trust obligations, which paid no interest, was $572,410,746. Of the stock-paying dividends 11.91 per cent of the total amount outstanding paid from 1 to 4 per cent, 7.84 per cent paid from 4 to 5 per cent, 7.41 per cent paid from 5 to 6 per cent, 4.21 per cent from 6 to 7 per cent, and 5.18 per cent from 7 to 8 per cent. The amount of dividends declared during the year ending June 30, 1899, was $111,009,822, which would be produced by an average rate of 4.96 per cent on the stock on which some dividend was declared. The amount of mortgage bonds paying no interest was $374,460,358, or 7.92 per cent; of miscellaneous obligations, $70,422,403, or 14.50 per cent, and of income bonds, $127,527,985, or 49.04 per cent.

The number of passengers carried during the year ending June 30, 1899, as shown in the annual reports of railways, was 523,176,508, showing an increase for the year of 22,109,827.

The average revenue per passenger per mile for the year ending June 30, 1899, was 1.925 cents. The revenue per ton of freight per mile was .724 cent.

For the year ending June 30, 1899, the gross earnings from the operations of the railways in the United States, covering an operated mileage of 187,534.68 miles, were $1,313,610,118, being $66,284,497 more than for the preceding fiscal year. The operating expenses were $856,968,999, the increase in this item being $38,995,723.

The income from operation, or the amount of gross earnings remaining after the deduction of operating expenses, generally designated as net earnings, was $456,641,119, an increase as compared with the year ending June 30, 1898, of $27,288,774. The average amount per mile of line for 1899 was $2435. The amount of income received from sources other than operation was $148,713,983. This amount covers the following items: Income from lease of road, $96,352,295; dividends on stocks owned, $20,104,521; interest on bonds owned, $11,334,690; miscellaneous income, $20,922,477. The total income of the railways, $605,355,102—that is, the income from operation increased by the income from other sources—is the item from which fixed charges and analogous items are deducted in order to reach the amount available for dividends. Total deductions from income amounted to $441,200,289, leaving $164,154,813 as the net income of the year available for dividends or surplus.

The amount of dividends declared during the year, including $80,114 other payments from net income, was $111,089,936, leaving as the surplus from the operations of the year $53,064,877, the corresponding surplus for the year ending June 30, 1898, being $44,078,557.

The total number of casualties to persons on account of railway accidents during the year ending June 30, 1899, was 51,743. The aggregate number of persons killed as a result of railway accidents during the year was 7123, and the number injured was 44,620. Of railway employees 2210 were killed and 34,923 were injured during the year covered by this report.

Street Railway Legislation in Massachusetts

The Massachusetts Legislature, which has just adjourned, enacted a large number of street railway measures. It may be said, however, that with one or two unimportant exceptions, no legislation was passed which was particularly inimical to the street railway interests of the Commonwealth. The enactment of the street railway act of 1898 has resulted in so much that was laudable that it has been found necessary to make no very serious changes in general laws.

Perhaps the most important bill passed was that requiring all street railway cars, purchased, built or rebuilt, to inclose their platforms during January, February, March, and October, November and December. A provision was added by the street railway committee, which exempts the city of Boston from the operation of the act, unless after a hearing the Railroad Commissioners decide that public safety will not be endangered by the use of vestibule cars.

A bill was passed which permits the Metropolitan Park Commission to grant locations in public reservations for metropolitan boulevards, parkways, etc.

A large number of bills were offered on petition to permit the formation of street railway freight companies. All of these bills were adversely reported by the committee, however, and in their place a bill was reported to provide that all street railway companies might become general carriers of merchandise, baggage and freight, subject to the same liabilities and restictions as pertain to railway corporations. This general bill was not desired by the street railway companies, as a whole, and as a result all attempts to substitute bills for special railway freight companies were defeated and the general bill was itself killed.

A bill was passed to provide that all uniformed letter carriers should be furnished free transportation on street railways.

Another bill passed provided that every street or elevated railway company shall transport scholars of the public schools, traveling to and from school, at a rate not exceeding $2.50 for one hundred rides. The companies now furnish one hundred tickets for $3, and it is proposed to test the constitutionality of this act, by proceedings brought by some bondholder of one of the larger roads against the corporation.

A compulsory bill was enacted to give the new Plymouth & Sandwich Street Railway Company the right to run upon the tracks of the Plymouth & Kingston Company, the Railroad Commissioners to determine the terms, conditions and compensation if the interested corporations fail to agree.

An attempt was made by several municipalities to secure the repeal of the Street Railway Act of 1898, or else the repeal of that portion of it which provides that municipalities must clear snow and ice from the streets through which the tracks run, but all these attempts proved abortive.

A resolution was enacted providing that the Railroad Commissioners shall consider the matter of requiring street railway companies to pay a proportion of the cost of the abolition of grade crossings in certain cases. This resolution was reported as a substitute for a bill which provided that the street railway companies may pay 5 per cent in all cases.

There was a disagreement over permitting the Webster & Worcester Street Railway Company to act as a common carrier of baggage, express and mail in the city of Worcester, in the towns of Auburn, Oxford and Webster. The matter finally went into the hands of a conference committee, which failed to agree, and therefore the bill fell through.

The law in relation to the use of street sprinkling apparatus on electric railways was amended so that the companies themselves can operate these cars in certain cases.

A bill was passed permitting the Amesbury & Hampton Street Railway Company to lease its roads and property to the Exeter, Hampton & Amesbury Street Railway Company, a foreign corporation.

There was a great deal of discussion over the joint use of tracks by railway companies entering Boston, the attempt being to secure compulsory legislation which would permit the new Boston & Worcester road to enter the city of Boston through Brookline. The bill, which was reported, was favored by all the Massachusetts companies, excepting the Boston Elevated, which opposed it on the ground that there would be great congestion in Boston, if outside railways were permitted to come within the 5-cent limit.

The result was that a general bill was passed, applying to all outside cities, but that the city of Boston was exempted.

The West Roxbury & Roslindale Street Railway Company was authorized to purchase the franchise and property of the Hyde Park Electric Light Company. The result of this is to permit this company to go into electric lighting.

A general bill was passed permitting receivers to sell the property, locations and franchises of street railway companies. There was quite an opposition to this measure, on the ground that a franchise was something which should revert to the municipality in case a street railway became insolvent, but the opposition was futile.

The time for building the Boston, Quincy & Fall River Bicycle Railway was extended to Dec. 31, 1901. If 20 miles are built by that time, all rights of the company shall be extended for one year more, in order that the full line may be completed.

The Lexington & Boston Street Railway Company was given permission to operate over private property in Billerica, Bedford and Lexington.

The Greenfield & Deerfield Street Railway Company was incorporated, notwithstanding the very earnest protest against such action by sentimentalists, who feared that the beauty of the main street of Deerfield would be effected by the location of a street railway through it.

A bill was passed which permits the Boston Elevated Company to have the right of appeal if dissatisfied with the estimate of the County Commissioners or the Aldermen of Boston as to damages for takings in constructing their road.

Among the street railway companies incorporated were the Phillipston Street Railway Company, to operate in Athol, Phillipston and Templeton; the Worcester & Gardner Street Railway Company, to operate in Worcester, Holden, Rutland, Hubbardston, Gardner, West Boylston and Princeton; the Winchendon Street Railway, to operate in that town only; while the town of Sunderland was permitted to subscribe for capital stock of bonds of the Amherst & Sunderland Street Railway Company, which was given an extension of time in which to construct in Sunderland.

A number of street railway companies were given permission to act as common carriers of parcels, United States mail, etc., among them the Gardner, Westminster & Fitchburg; the Palmer & Monson, the Norton & Taunton, and the Interstate Consolidated.

Patent Decision on Trucks

An important decision was rendered last month in the Circuit Court of the United States for the Southern District of New York in the case of John A. Brill vs. Third Avenue Railroad Company. The suit was brought for the infringment of claims 1, 2, 9, 10, 11, 12, 14, 17 and 27 of letters patent No. 478,218, applied for June 26, 1891, and issued on July 5, 1892, to George Martin Brill for an improvement in car trucks. These claims are as follows:

1. In a motor truck, the combination, with a stationary frame supported upon the running gear, said frame having sections extending outwardly from the axle, of a movable frame supported upon said truck, spiral springs located between the movable and stationary frames, and elliptical springs located between the extended sections of the said rigid frame and movable frame, substantially as described.

2. In a truck, a spring-supporting frame supported upon the running gear by saddles and having sections extending outwardly from the axles, a movable frame having like extensions, spiral springs located between the saddles and movable frame, and elliptical springs located between the spring-supporting frame and the movable frame, substantially as described.

9. In a truck, the combination of two frames, one stationary and supported upon the running gear, the other movable, and a plurality of springs located between the stationary and movable frames, some of said series being adapted to be compressed by the downward movement of said movable frame subsequent to the compression of other of the series, substantially as described.

10. In a truck, the combination of two frames, one stationary and supported upon the running gear of the truck, the other adapted to be moved toward said stationary frame, springs located between the ends of both frames, and springs otherwise disposed between the two frames, the end springs being adapted to be compressed subsequent to the compression of the other springs, substantially as described.

11. In a truck, a stationary spring-supporting frame having at its ends elliptical springs rigidly secured thereto, in combination with a movable frame supported by springs other than said elliptical springs, said movable frame being provided with devices for engaging said elliptical springs, the elliptical springs being adapted to be brought into action subsequent to the springs supporting the movable frame, substantially as described.

12. In a truck, a spring-supporting stationary frame mounted on the running gear of said truck, said frame being composed of a plurality of bars contiguously disposed, a saddle secured to the outer sections of said bars, an elliptical spring, the lower section of which rests upon said saddle, and a second saddle disposed over the first, and the spring secured to the first saddle, a movable frame, spring supported upon the stationary frame and having devices for guiding the upper section of the elliptical spring, substantially as described.

14. A truck having running gear and a frame, and spiral springs for supporting the car body, supplemented by elliptical springs adapted to co-act therewith, the spirals being adapted to be compressed prior to the ellipticals, substantially as described.

17. The upper chord having the depending cap 45, with downwardly extending legs 46, and elliptical springs held on the side beams, adapted to move in said cap, substantially as described.

27. In a truck, a stationary spring-supporting frame mounted on the running gear of said truck, having outwardly extending sections and elliptical springs secured to the stationary frame, and a movable frame, having a device for guiding the upper portion of the elliptical springs, substantially as described.

One hundred and eighty-one infringing trucks were purchased by the defendant from the Bemis Car Box Company, of Springfield, Mass., which, it is admitted, "is defending the present suit for the Third Avenue Railroad Company."

The decision was rendered by Judge Shipman, and is quite an extended one.

After reviewing the difficulties of supporting a long car on a short wheel base, the judge says: "The gist of the invention consisted in combining with frames of the truck and the spiral springs another class of springs, viz., elliptical springs, between the car body and the extensions of the independent frame. The elliptical springs are slower in their action than the spiral springs, and neutralize the longitudinal oscillation of the car body. Mr. Akarman, a practical trolley railway superintendent, stated the result and the reason of it, as follows: 'From a practical observation my opinion is that the combination of an elliptic and spiral spring, as applied in trucks of this type, breaks the rhythm of motion or interrupts it. In trucks with all spiral springs, or, I should think, if it were possible to construct a truck having all elliptic springs, the rhythm of motion is perfect, the springs acting in unison. In the truck, as previously described having the combination of elliptic and spiral springs, the rhythm is broken and the result is that the galloping or rocking motion is done away with.'

"This leading feature of the invention is described in claims 1 and 2, which do not contain the limitations of the invention described in the next paragraph. A second and minor feature of the invention described in claims 9, 10, 11 and 14, is such an arrangement of the elliptical springs with the car body that they 'will not come into play until after the axle-box springs have begun to compress, and the action of the spiral springs in lifting the car body is continued after the elliptical springs have ceased to act.' The elliptical springs are not depressed until the car body or one end of it has become depressed by the weight of the passengers or some other cause, when this slower motion interposes and checks the continuation or increase of oscillation.

"Upon the question of the novelty of the invention described in claims 1, 2, 11, 12 and 14, the defendant's expert puts great stress upon letters patent No. 409,993, dated Aug. 27, 1889, to Benjamin F. Manier. One object of Manier was to prevent oscillation, and to accomplish it he employed an extended spring base and mounted the body springs forward of the axles. He said that oscillation was noticeable in cars mounted on trucks wherein the body springs are on both sides of the axles and near the center of the truck, and that the mounting of the body springs forward of the axles he considered a special feature of his invention. The springs, or the kind of springs, which he was to use, are no part of his invention. He says: 'Preferably I employ spiral springs *G*, as shown in Fig. 1 for supporting caps *I*, but, if desired, the elliptic spring *g* could be employed, as shown in Fig. 3, or other forms of springs may be used as found convenient and desirable, the particular form of spring not forming part of present invention.' Manier's invention was entirely apart from that of Brill, and had no conception of its character. The only ground upon which the expert can place his theory is that in Fig. 3, the two different forms of springs, spiral and elliptic, are shown, and upon this drawing the entire superstructure of anticipation is built. Manier's invention was not designed, nor adopted, nor used for the performance of the function performed by Brill's device, nor was the way to accomplish Brill's result suggested by Manier's invention." —(Topliff vs. Topliff, 145 U. S., 156.)

The judge then refers to earlier patents claimed by the defendants to anticipate the Brill patent, notably the Bird, Diehl, Vose and Peckham patents, but these were held by the judge not to be anticipations. He then concludes:

"The only remaining question is that of patentable novelty. It has already appeared that the gist of the invention is described in claims 1 and 2. The necessity for a remedy against the pounding of the car, the importance of the result, the adoption of the invention by experienced railway superintendents, the number of previous attempts at a remedy and the barrenness of their results go far to show that the work of an inventive mind was required and was active in the invention. The testimony of the defendant's expert itself, as he goes through the history of the art and thereby points out what the patentee's combination did, as compared with previous efforts to do something, shows that the patented improvement was patentable. The result of the minor invention of claims 9, 10, 11 and 14 was important, although upon first inspection its marked importance does not appear, but it perfected the general invention of the first two claims. The combination shown in claims 12 and 27 was patentable. The simple combination in claim 17 of the uppper chord, with its depending cap and down-

wardly extended legs and elliptical springs, does not appear to me to have have been patentable.

"Let there be a decree, with costs, for an injunction against the infringement of claims 1, 2, 9, 10, 11, 12, 14 and 27, and for an accounting if it is asked for."

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED JULY 22, 1900.

654,274. Railway Switch; M. O'Dowd, Chillicothe, Ill. App. filed Oct. 27, 1899. The invention comprises a pitman and tie-bar, the tie-bar being provided with a wrist pin, while the other member is provided with a hole to receive the wrist pin. The pitman is provided with a hooked nose adapted to enter a recess in the tie-bar, the nose and recess being so shaped that the pitman can rotate about the axis of the pin within the required range for the operation of the switch without causing a separation between the nose and the recess. This coupling is intended to dispense with bolts and nuts.

654,327. Automatic Switch; T. S. Savage, Oakland, Cal. App. filed April 19, 1900. The switch point is held in one position by a spring; the car wheel depresses a lever and moves the point against the spring.

654,348. Trolley Harp; E. G. Johnson, Brigantine, N. J. App. filed Feb. 16, 1900. The wheel is mounted on an elongated axle, along which it may assume any position, a tendency to run in the middle of the axle being supplied by springs bearing against each side of the wheel.

654,352. Car Seat; W. M. Norcross, Philadelphia, Pa. App. filed May 6, 1899. The back, seat and a foot rest on each side are connected with each other by a system of levers, which effects the adjustment of each part to its proper position when the back is shifted from one side to the other.

654,448. Trolley Base; H. S. Goughnour, Johnstown, Pa. App. filed Sept. 23, 1899. An arrangement of torsion springs with the base of the pole whereby a "low" base is obtained.

654,452. Railway Frog; C. F. Kress, Jr., Johnstown, Pa. App. filed Dec. 28, 1899. A railway frog composed of girder-rails and a central metal chock cast to said rails, said rails having their head portions fitted and abutted to form the entire wear surface of the frog, and the cast metal chock filling the entire space between the underneath abutted portions of said rails.

655,574. Trolley Track for Electric Railways; V. Koch, Scranton, Pa. App. filed Feb. 24, 1900. A crossing constructed from a circular plate integrally made with projections thereon corresponding to the ends of the rails of the trolley track, and adapted to be joined therewith for the purpose of completing the electrical circuit through the said track.

New Publications

Derrah's Official Street Railway Guide of Eastern New England. 248 pages. Illustrated. Price (by mail), 20 cents. Published by Robert H. Derrah, 53 Devonshire Street, Boston.

The excellent work which Mr. Derrah is doing in developing the trolley excursion business in New England should form a model for similar efforts in other parts of the country. Mr. Derrah has shown how the publication of a well illustrated and excellent guide book, showing how interesting points can be visited by trolley, running times of the cars, fares, etc., will, to use a very old expression, fill a long-felt want. The guide for this year is the fifth annual of its kind to be issued by the publisher, and contains a fine portrait of H. M. Whitney, who, as the author says, is largely responsible for the commercial development of the trolley system. It also contains an excellent map of Eastern New England with the trolley lines. The guide is published with the approval of the street railway managers, whose traffic must undoubtedly be largely stimulated by its publication.

PERSONAL MENTION

MR. W. BARRON, manager and purchasing agent of the Brantford Street Railway Company, of Brantford, Ont., is dead.

MR. ROBERT DUNNING, formerly master mechanic for the Buffalo Railway Company, has been appointed master mechanic for the Washington Traction & Electric Company, of Washington, D. C.

MR. J. J. COLEMAN, formerly general manager of the St. Louis Transit Company, has been appointed assistant to the president of the Washington Traction & Electric Company, of Washington, D. C., to superintend the operation of the lines in the district.

MR. C. O. BRUNNER, treasurer of the Bethlehem Iron Company and Bethlehen Steel Company, completed, on July 12, his fortieth year of service. The occasion was marked by the presentation to Mr. Brunner of a silver pitcher and salver and a handsome cane from his fellow members of the staff of the two companies.

NEWS NOTES

LITTLE ROCK, ARK.—The City Council has adopted the Mayor's recommendation in regard to the operation of the Little Rock Traction & Electric Company, and has also adopted a resolution providing that if the company does not comply with the charter, relative to putting the system in first-class order within ninety days, that the Council will proceed at once to nullify the franchise and declare the property a public nuisance. The Mayor's message to the Council was as follows: "I deem it my duty to urge upon you the necessity of taking some decided action relative to the franchise of the Little Rock Traction & Electric Company. The numerous derailments and the inconvenience to and the hardships imposed on the general public July 4, because of the very poor physical condition of its force and rolling stock, has caused such universal condemnation that it amounts to a demand upon us to take action, inasmuch as all former petitions to this company have been ignored. I would therefore recommend that the city attorney be instructed to apply to the United States Court to have the receiver make the necessary improvements within a reasonable time, and in the event this is not done that he at once take steps as may be necessary looking to the annulment of the contract between the city and said street railway company."

BRIDGEPORT, CONN.—The fare between Bridgeport and New Haven via the Bridgeport Traction Company's and the Winchester Avenue Company's lines is to be reduced to 25 cents. At present it is 35 cents, pay as you go, or 30 cents if you buy your ticket in advance.

BRIDGEPORT, CONN.—The Bridgeport Traction Company is now repainting and overhauling its entire winter rolling stock. A force of forty men are employed on the work, and the work will be completed by the season for the withdrawal of the open cars. The body of the cars being redecorated is painted a medium chrome yellow, while the lower portion under the windows is a cream white. Upon this is inscribed the words "Bridgeport Traction Company." The platform gear and trucks are Venetian red, while the body is finished with heavy stripes of deep orange and narrow lines of Tuscan red and black. The car number is in silver, shaded in Tuscan red.

WASHINGTON, D. C.—A car of the City & Suburban Railway jumped the track at the corner of Second and R Streets northeast on July 21, injuring several persons.

WASHINGTON, D. C.—Since the fatal accident to one of the city firemen, due largely to the electric cars stopping on the far side of crossings, the question of reverting to the old plan of stopping on the near side has been considerably agitated by the local press and the citizens, and there is a strong probability that the District Commissioners will shortly issue a notice to the effect that the electric cars will stop at all street cossings on the near side.

WASHINGTON, D. C.—The District Commissioners lately transmitted to the street railway companies here a list of proposed stopping places for the street cars on certain routes taken by the apparatus of the fire department in answering alarms of fire. The companies have replied to these communications, setting forth their reasons for not stopping at some of the points designated by the Commissioners, and agreeing to stop at the others. The exceptions noted are all based on excellent reasons, and no doubt the Commissioners will agree with the street railway companies and modify their requests accordingly.

ATLANTA, GA.—The Atlanta Railway & Power Company is now giving transfers on its lines up to 11 p. m. Heretofore no transfers have been issued after 8 p. m.

LA SALLE, ILL.—The City Electric Railway Company and the city officials are at loggerheads. The authorities have prevented the company from erecting new poles along its route, and have also tampered with the company in other respects. J. R. Burrows, as receiver for the company, is seeking an injunction to prevent further interference with the operations of the company.

CHICAGO, ILL.—A fire in one of the cars of the South Side Elevated Railroad Company on July 14 came very near causing a serious disaster. Soon after the train, carrying 150 passengers, left Eighteenth Street, fire was discovered in the center of one of the cars, and the passengers immediately became panic stricken, despite the efforts of the guards to quiet their fears by telling them that the fire was nothing more than smoke arising from a blown out fuse. Many passengers attempted to jump from the train, but were restrained by the guards, who assured them that the fire would not get beyond control even if it could not be put out.

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Akron Power House Badly Damaged by Fire

The Northern Ohio Traction Company's new Akron power house was badly damaged by fire July 29. The loss will probably exceed $35,000. The fire started in the boiler room, where an exploding flue in one of the boilers scattered live coals about the room. Waste about an oil tank caught fire and an explosion followed. The boiler and engine room was almost totally destroyed and the generators were badly damaged by heat and water. The plant was installed by the Westinghouse company, and had but recently been turned over to the company by them. The fire tied up the Akron city lines and the Akron, Bedford & Cleveland Electric Railway until power could be secured from the Cuyahoga Falls power house.

The Street Car Float Idea Spreading

The street car float idea seems to have taken hold of the managers in the West. Since the inauguration of this idea during the Mardi Gras celebration in New Orleans there has been considerable talk by the Western managers of making this a feature of carnivals, etc., and since that time the float idea has been used to advantage in Milwaukee. Now it is announced that Wichita is planning to surprise its citizens by utilizing the floats in a coming festival in that city, and that President McGowan, of the Indianapolis Street Railway Company, is arranging to make the floats an important feature of the carnival in that city in October. As the ideas of the Wichita and Indianapolis managements are not known in regard to the design and subjects of their floats, it is probable that we may see some radical changes in both design and subjects.

Chicago Street Railway Questions Likely to be Submitted to the People

It is reported from Chicago that the street railway questions now being considered by the Street Railway Commission will be submitted to the people by an informal referendum if a satisfactory method of reaching the public can be devised. One proposed method of securing the suggestions of the people is to ask citizens to appear before the commission with their opinions. For this purpose a number of representative men will be asked, as the traction companies have been asked, to submit statements of their views for the consideration of the commission. To reach the people more directly and to submit propositions which affect them it is proposed that circulars be used. The questions of municipal ownership, long term franchises, and the terms which should be demanded in granting them, can be stated and opportunity for a statement of opinions given. The expressions thus secured will be formulated as a statement of public opinion.

Disappointments in City Census Returns

The citizens of Washington, Cincinnati and Buffalo, of which official returns as to their population have been made by the census officials, are greatly disappointed at the showing made by their respective cities. From all accounts, the citizens of Washington are deepest in their gloom, and the estimates of the local authorities on such subjects have been shattered. All sorts of estimates had been made regarding the wonderful growth of the city, but they were all destroyed by the official returns, which show no perceptible gain. How is this accounted for? This is the question they have asked themselves, and, after careful consideration, have laid the responsibility at the door of the electric railway, which has worked so many other wonders since the compilation of the last census. The suburban development stimulated by the wide and rapid extension of the electric railway is held accountable for the results. The increase in Cincinnati has been but 9.77 per cent for the ten-year period, and at Buffalo only 37.77 per cent for the same period, as against 64.8 for the period of 1880-1890. These are the first returns of the census officers, and as subsequent reports are made the estimates of population in other cities are liable to receive a serious shock. The electric railways have built up that portion of the country surrounding the cities which in the times of the horse car were inaccessible because of that slow mode of locomotion, and yet were not quite distant enough to build up a steam railroad traffic. In all, it has filled a long-felt want, and the latest reports show that it has even exceeded the expectations of its early champions, who predicted relief for the congested city districts on its advent.

Electricity on the Manhattan Elevated Railroad

General Superintendent W. E. Baker, of the Manhattan Elevated Railroad Company, of New York, has announced that the electrical equipment of the company's lines will be completed by Oct. 1, and that at least one trial train will be operated over its Second Avenue line by that date. The company's new power plant will not be sufficiently advanced to furnish power at so early a date, but the Metropolitan Street Railway Company will supply power temporarily from its new plant at Seventy-Fifth Street and the East River. The new electric trains will consist of six cars, instead of five, as at present, and will run on one-minute headway. They will consist of two motor cars, one front and one rear, and four regular passenger cars. The one additional car will permit of the handling of a considerable number of passengers, and will be especially useful in rush hours. The plans for the electrical equipment also call for the substitution of the gas lighting system now in use on the cars and in the stations with electric lights and the installation of a telephone system connecting all stations. Contracts are now being let for the installation of these systems. The motor cars will each be equipped with four 100-hp motors, thus giving a total of 800 hp to each train.

Collecting Fares on the Brooklyn Rapid Transit

The Brooklyn Rapid Transit Company has ordered that its conductors ring up the fare immediately after the passenger boards the car. This system has long been in use on the Coney Island & Brooklyn Railroad, and its adoption by the larger company is largely due to the apparent success there observed. W. W. Wheatley, general superintendent of the Brooklyn Rapid Transit, states that the new arrangement is not made as an experiment, but that after careful investigation the management has decided that without imposing unreasonable annoyance on the conductor it has a decided tendency toward preventing the "skipping" of fares, and for this reason it has been permanently adopted. Mr. Wheatley asserts that the conductors themselves, especially the older men, appreciate the advantages of the system, and are perfectly satisfied with the change. This is probably partly due to the peculiar sense of honesty with which such a large portion of the traveling public is affected. Many passengers who would attempt to ride free if they thought the railway company only would suffer and do not realize the severity with which "skipping" is looked upon, would condemn as the grossest meanness the cheating of a conductor out of a fare. Another advantage of the system is that dishonest conductors cannot fall back on the excuse of not having collected the fares when questioned by an inspector regarding discrepancies in the number of passengers and the register indications. In case a person boards the wrong car the conductor merely makes a note to that effect on the back of his day card, and is thus relieved of all responsibility. By the adoption of this system the former use of double registers has been necessarily discarded, cash fares and transfers being rung up on the same register.

Plans for a Chicago Subway

On July 25 President John M. Roach, of the Union Traction Company, of Chicago, presented the Street Railway Commission with detailed plans for the construction of a downtown subway system in Chicago. The cost of constructing the proposed subway is estimated at $25,000,000. In drawing the plans for the new tunnel careful consideration was made of the underground systems of London, Boston, Buda-Pest and the plans for the New York tunnel. The plan in general provides for the construction of six distinct loops diverging from a transfer point beneath the heart of the city, and include the construction of about 10 miles of underground road.

The following are the routes as proposed:

Dearborn Street Subway—Enter river tunnel at Michigan Street, to Madison Street, to State Street, to Randolph Street, to Dearborn Street.

LaSalle Street Subway—Enter river tunnel at Michigan Street, to Madison Street to Dearborn Street, to Randolph Street, to LaSalle Street.

Washington Street Subway—Enter river tunnel as at present, to Franklin Street, to Monroe Street, to Dearborn Street, to Madison Street, to Franklin Street, to Washington Street.

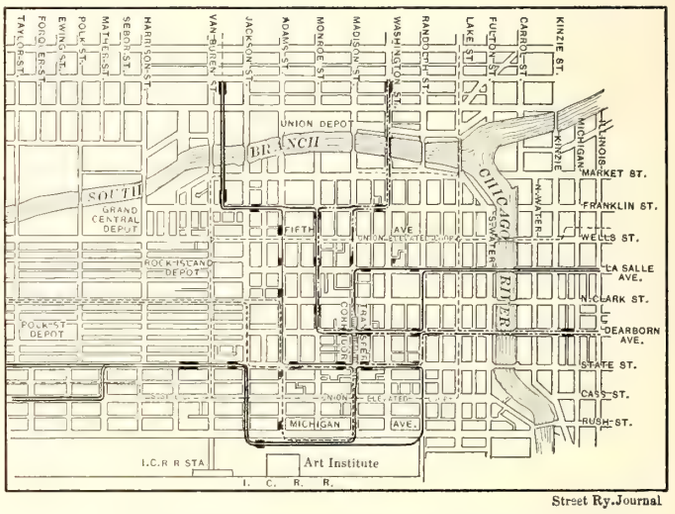
Van Buren Street Subway—Enter river tunnel as at present, to Franklin Street, to Adams Street, to State Street, to Madison Street, to Dearborn Street, to Monroe Street, to Franklin Street, to Van Buren Street.

Clark Street Subway—Enter at Twelfth Street, to Jackson Street, to State Street, to Adams Street, to Michigan Street, to Madison Street, to Dearborn Street, to Adams Street, to Clark Street.

State Street Subway—Enter at Twelfth Street (Wabash Avenue at Hubbard Court), to Jackson Street, to Michigan Street, to Randolph Street, to State Street, to Madison Street, to Michigan Street, to Jackson Street, to State Street.

The plan provides for the issuance of transfers at a station to be located under Madison Street, between Dearborn and State Streets. All loops are to touch this transfer corridor and thus permit of a ready change of cars by passengers.

According to the specifications, the bottom of the tunnel is 32 ft. below the street level. Underground work is provided for, sewer work and gas mains being placed above, instead of below, the



GENERAL PLAN OF CHICAGO SUBWAY

transportation tunnel to prevent the escape of gases into the tunnel proper and lessen the danger in case of explosions.

The tunnel is to be 32 ft. wide and 14 ft. high, separated into two compartments for an up and a down track by a wall of masonry. The tracks are 30 ft. below street level, while the platforms are constructed about 15 ins. higher. Sewage, which in Chicago has proved an obstacle to all subway plans, is cared for by iron pipes on either side of the street, as well as one deeper system below the tunnel proper. Mr. Roach believes the upper sewers will drain surface water from the streets, while the smaller one below will furnish drainage for other wastes.

Between the top of the subway and the street level are conduits for telephone and telegraph wires, electric light cables, all city wires and pneumatic tubes. Compartments 6½ ft. deep and 5½ ft. wide are provided. President Roach has this to say of the plans:

"The plans were drawn hastily and without a study of details, such as I should desire. They embody features that seem to me desirable, and can be used to advantage by the commission. The street railway companies are not ready to make a proposition for the construction of any such system. The Chicago City Railway Company has not worked in the preparation of these plans, and it is likely some outside corporation would like to secure the right."

Special Meeting of the Massachusetts Electric Companies

At a special meeting of the stockholders of the Massachusetts Electric Companies held July 30 it was voted as follows:

"To amend the declaration of trust by changing the dates for the payment of semi-annual dividends of the preferred shares from the first days of June and December to the first days of January and July of each year.

"To approve the purchase of the stock of the Lowell & Suburban (12,000 shares) on the basis of two shares of preferred and one and one-half shares of common stock of the Massachusetts Electric Companies for each share of Lowell & Suburban stock.

"To approve the purchase of the stock of the South Shore & Boston (6900 shares) on the basis of one share of preferred and three-quarters share of common stock of the Massachusetts Electric Companies for each share of South Shore & Boston stock."

At the meeting President Gordon Abbott said in part: "The first fiscal year ends Sept. 30, and before the annual meeting on

Nov. 7 a full report of the year's operations will be sent to all the shareholders; meantime a few figures as of June 30 last may be of interest. When on that date a year ago the trustees organized they received either all or a controlling interest in the shares of thirty-one corporations, two of which were lighting companies. Since then four other companies have been acquired, including the South Shore & Boston and the Lowell & Suburban, whose acquisition you are asked to-day to approve."

He then referred to the consolidation into system of the various roads controlled by the company, and continuing said: "The results of the operation of the companies in which you are interested, excluding as before the Lowell & Suburban and the South Shore & Boston and also the New Bedford, Middleboro & Brockton, which company had not been acquired by the trustees at this time last year, are as follows, comparisons being made with the same period of the fiscal year, 1899:

	1900	1899	Increase	
Gross earnings.....	$3,102,518	$2,809,464	$293,053	10.4%
Operating expenses..	2,132,679	2,087,898	44,781	2.14%

Operating ratio 68.75%.

"For the same period of nine months the net divisible income, after deducting all interest and other charges, has increased by $207,893. These figures do not fully represent in the improvement in the net divisible income, for the following reason: Believing it wise to provide a general fund as an insurance against losses caused by accidents to persons, the companies in which you are interested mutually established such a fund at the beginning of the present fiscal year, and each company now makes quarterly payments of a percentage of its gross earnings. The balance to the credit of this fund on June 30 was $117,000. Inasmuch as damage cases are seldom settled until some months after the accident occurs and inasmuch as only those accidents which happened since the first of last October are properly chargeable to this fund, the companies have been paying a double charge during the last nine months, because while they have been making the payments to the new fund they have been at the same time obliged to settle a number of claims antedating the establishment of that fund; therefore, in making a strict comparison of the results it would be proper to add the balance of this accident fund to the increase in net divisible income, making the total increase $324,893."

The Utilization of Water Power for the Electric Railway System of Minneapolis and St. Paul *

BY EDWARD P. BURCH, CONSULTING ELECTRICAL ENGINEER

It is well known that within a few years a new dam has been constructed in this city across the Mississippi River just below St. Anthony Falls, that electricity has been generated by the power produced at the dam, and that the power has been utilized for the electric railway system of Minneapolis and St. Paul. It is the purpose of the lecture to review the engineering which has recently been accomplished in the utilization of this power.

THE MISSISSIPPI RIVER

The source of power is the upper Mississippi River, a peculiar stream; generally quiet and governable, yet at times of flood apparently beyond control. The flowage characteristics have been averaged year after year until we are certain of the general nature of the annual changes. By providing liberal margins we can predict with fair accuracy the amount of water which can be depended upon. These characteristics are given in Fig. 1, which shows the months of the year along the base line and the flowage in cubic feet per second vertically.

The flowage changes materially during the different seasons. During the first months of the year the lakes and great swamps in the northern part of our State freeze so solid that the flowage is greatly diminished. As warm weather comes on in April, the melting ice and snow invariably produces a flood, so that within a week of a spring break-up the volume may increase ten-fold. The summer flowage is several times greater than the winter flowage. There is commonly a second flood in September, after which the amount of water gradually decreases as cold weather comes on.

These characteristics of flowage are changing quite materially. The United States Government is constructing permanent dams at the outlets of the great swampy lakes on the upper Mississippi, thus forming immense reservoirs. The object of these reservoirs is to collect surplus water, principally in the spring and fall, which may be systematically released, especially in case of drought in midsummer or late in the fall. This storage capacity may ultimately become 100,000,000,000 cu. ft.

* Paper read before the Northwestern Railway Club, April 10.

Not only is the intensity of the spring and fall floods thus reduced, but navigation is facilitated and a more equitable distribution of water for power results. As this immense reservoir system grows, the curves of flowage become more nearly flat. At present the general mean minimum flowage in February is about

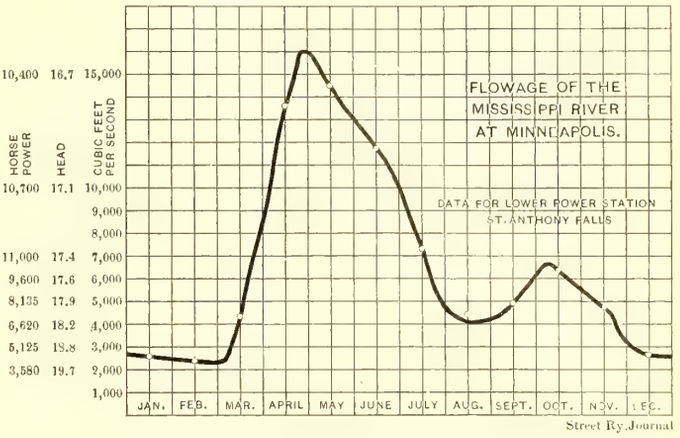


FIG. 1.—FLOWAGE OF RIVER AT MINNEAPOLIS

2500 cu. ft. per second, the spring flood commonly reaches 15,000 cu. ft. per second, and the summer flowage at least 6000 cu. ft. per second. By utilizing local storage the amount of power available may be increased 10 per cent at times of heavy demand.

ST. ANTHONY FALLS

Within the limits of the Twin Cities the Mississippi has a fall of over 110 ft. Just above the city limits there is what is known as Coon Rapids, where there is a fall of 20 ft. This power has not been developed. Between the Minneapolis Western Railroad bridge at Eleventh Avenue South in Minneapolis, and Fort Snelling bridge in St. Paul, there is a fall of 40 ft., along which the government has laid out and is now constructing locks and dams.

The main St. Anthony Falls, with a fall of 50 ft., have been utilized for forty years. With normal summer flowage, 6000 cu. ft. per second, about 25,000 mechanical hp are available and are used, largely for flour manufacturing.

CONSTRUCTION OF THE NEW DAM

St. Anthony Rapids, just below the main falls, has been developed within the last few years. The construction of a dam below what was formerly known as the "rapids" (now known as the lower power) had been in the minds of capitalists and engineers for many years. With normal summer flowage it was estimated that a dam giving a 20-ft. fall could develop 10,000 hp.

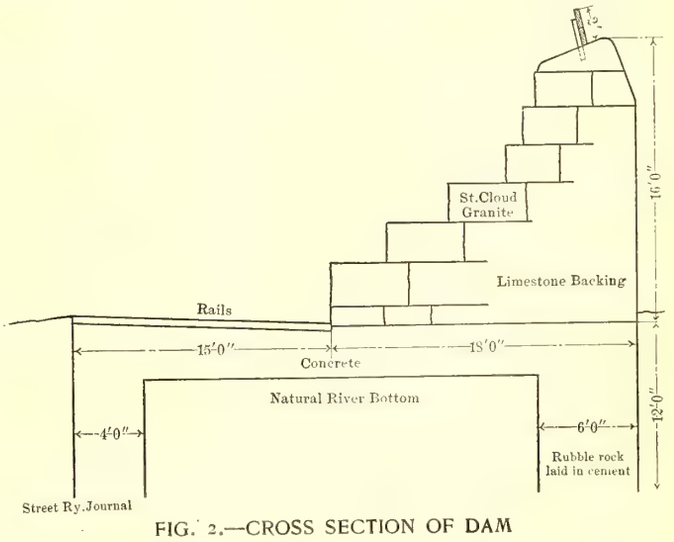


FIG. 2.—CROSS SECTION OF DAM

The riparian owners, St. Anthony Falls Water Power Company, having procured ample English capital, their hydraulic engineer, William de la Barre, started the construction of this new Lower Dam at St. Anthony Falls in May, 1895. The work was finished and turned over to an operating company Jan. 1, 1898. Fig. 2 shows a map of the upper and lower power at St. Anthony Falls.

In the construction of the lower power the general plan carried out was to build a dam directly across about two-thirds of the main river, then making an obtuse angle, run diagonally across toward the east bank to a power station at the foot of the canal or

head race thus formed. This plan of construction was a most advantageous one. The walls of the canal were built first, and on the dry east bank the great waste gates were installed and the power station foundations were completed, all during the first season.

The second year, 1896, the water of the entire river was de-

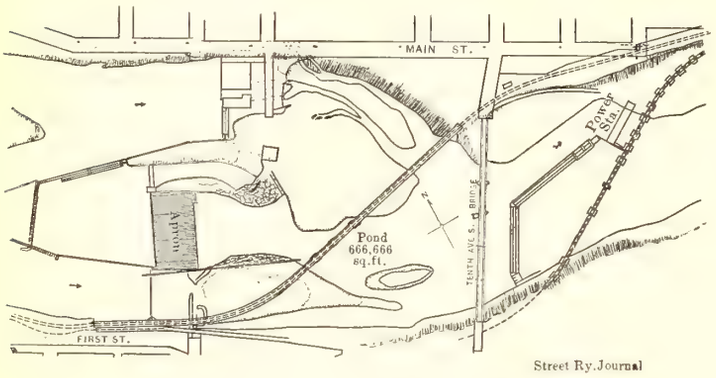


FIG. 3.—MAP OF UPPER AND LOWER DAM

flected from its old bed into the new canal and sent through the waste gates and also under the power station. A coffer-dam was then built across the old bed of the river. The main dam, located 2000 ft. below the upper falls was then started, and was nearly completed during the second year. At the beginning of the third year, the spring of 1897, a most disastrous flood, amounting to 60,000 cu. ft. per second, swept away the coping and other portions of this section. In repairing this break, a rock-filled, timber-framed approach, lined with steel plate was built in front of this section of the main dam, in order to ease the battering which piers, logs and ice give the structure.

Examining the plan as a whole, note that the great length of the dam allows the water to fall over a very long crest of the dam during a flood, thus lessening the wear and tear of the fall by distributing it over a greater surface. A cross-section of the main dam is shown in Fig. 3.

The dams are 1085 ft. long. The height of the dams is from

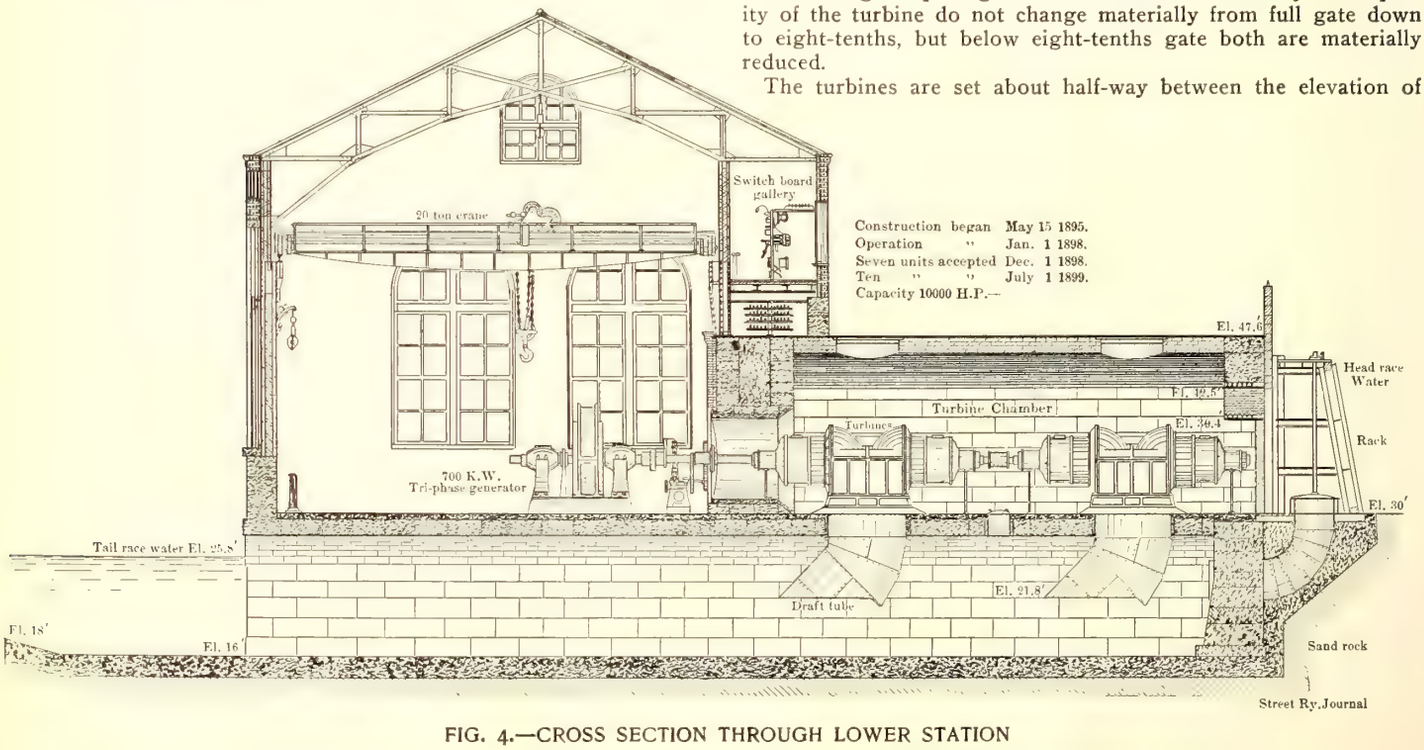


FIG. 4.—CROSS SECTION THROUGH LOWER STATION

14 ft. to 16 ft. above the river bed. Below the superstructure there is a 3-ft. base of concrete, 33 ft. wide. This base is especially well reinforced by a rubble rock and concrete dyke construction in the sand rock below the crest line of the dam and again at the toe of the dam. This will prevent undermining. The face of the dam is perpendicular. The down-stream side is so shaped or sloped as to ease the momentum of the water and discharge it horizontally, thus preventing an undertow which might prove fatal to the structure.

The main structure is of limestone from the quarries on the east bank of the river. The facings are of St. Cloud granite. The coping is lined with skeleton steel plate and the base of the dam with steel rails in 15-ft. lengths laid side by side in cement. These rails are laid with their outer ends 6 ins. higher than the end next to the dam—thus a pool of water is formed which acts as a cushion and protects the concrete work from erosion.

THE STATION

The power station forms 200 ft. of the dam. Inside, it is one large room 250 ft. long, from 45 ft. to 55 ft. wide, and 50 ft. high inside. The station is heated by electric heaters; a 20-ton traveling crane is provided.

The station, shown in section, Fig. 4, is built on solid sand rock. First, a concrete base, the present tail-race floor and foundation for tail-race arches, was laid 2 ft. thick under the power station. The top of ten tail-race arches forms the floor or substructure of the station. The turbine chambers and the tail-race arches are spaced horizontally 20 ft. apart from center to center. Large sulice gates allow a by-pass for the water in front of the chambers to the race below. In front of the entrance to the turbine chambers, a structural steel framework is formed to support the racks—a steel screen of ¼ in. iron, 3½ ins. wide and spaced 1 1-3 ins. apart, to prevent the entrance of floating logs, bark and ice.

THE TURBINES

In the water chambers ten large turbine units were installed. The capacity of each unit is approximately 1150 hp on 20-ft. acting head at 130 r. p. m. The capacity of the turbines varies as the square root of the cube of the acting head. There is one speed on any given head at which they run at highest economy, this speed varying with the square root of the head. Thus, on 17½-ft. head the horse power would be

$$1150 \times \sqrt{\left(\frac{17.5}{20.0}\right)^3} \text{ or } 940,$$

and the most economical speed 121.6. If a higher or lower speed is used on 17½-ft. head, the horse power capacity of the turbine is materially less. At 190 r. p. m. the horse power capacity is naught.

The object of the turbine governor is to provide a speed of 130 revolutions, given any head and any load which may be on the generator. This is done by a centrifugal governor which controls the turbine gate opening or water inlet. The efficiency and capacity of the turbine do not change materially from full gate down to eight-tenths, but below eight-tenths gate both are materially reduced.

The turbines are set about half-way between the elevation of water in the head and tail-race. The pressure above the turbine runner and the suction from the draught tubes together form the head on the turbine. Should the normal elevation of water in the head race increase 2 ft. during a common spring or fall flood the normal elevation of water in the tail-race would make a corresponding increase in elevation of 5 ft., or even above the floor of the power station should the flowage amount to 30,000 cu. ft. per second. The result is that during a flood there is a smaller quantity of water per turbine and a much lower acting head. Therefore, the capacity of each unit and of the power station is

always the least when the quantity of water in the river is greatest and vice versa. Floods as well as droughts are thus undesirable.

The acting head on the turbines is nearly 1 ft. less than the fall of water produced by the dam. This is due to friction losses

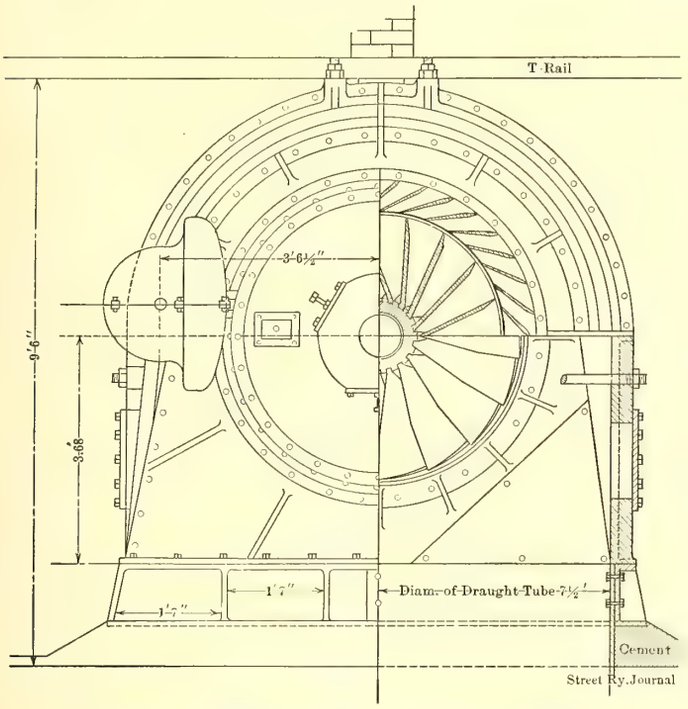


FIG. 5.—CROSS SECTION OF 46-IN. TURBINE

past booms, through racks, eddies in the turbine chamber, and the piling up of the water discharged by the draft tubes.

Drawings of the turbines are given in Figs. 5, 6 and 7.

Each 1150-hp turbine is directly connected to a 1000-hp electric generator, the turbine shaft passing through a water-tight flume cover into the generating room. Ten 1000-hp and two 150-hp

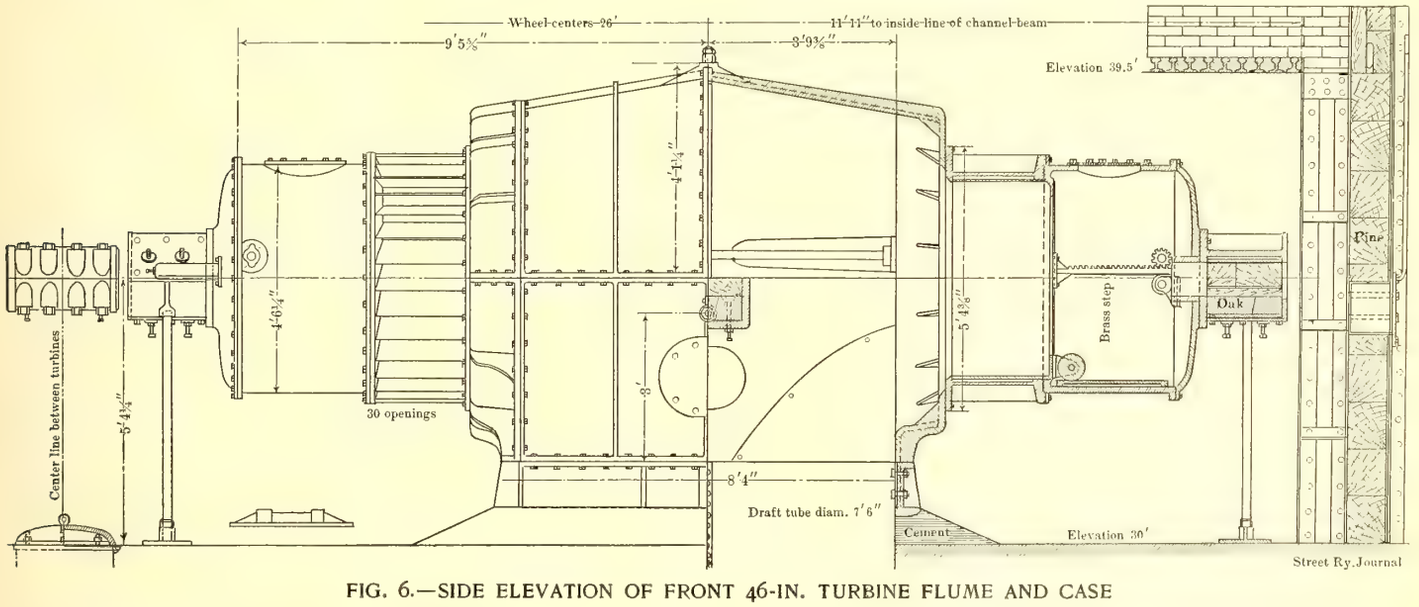


FIG. 6.—SIDE ELEVATION OF FRONT 46-IN. TURBINE FLUME AND CASE

generators have been installed. The generators are of two classes or types, well adapted to the work of distribution to be referred to later. The power, after being converted into electricity, is sent to the switchboard in the gallery, where it may be controlled and distributed.†

THE TWIN CITY RAPID TRANSIT COMPANY'S ELECTRIC RAILWAY SYSTEM

The power service is now ready. One of the corporations to whom propositions were sent on the sale of the power, was the Twin City Rapid Transit Company. This company has an electric railway franchise, owns and operates the entire electric railway system of Minneapolis and St. Paul. It has 240 miles of track in service. Its annual revenue is over $2,500,000, coming nickel by nickel from 50,000,000 passengers. Its annual car mileage is 13,000,000. The maximum number of cars in ordinary daily service is about 400; in maximum service, 550.

From 1891 to 1897 it had four steam plants with a capacity of 11,500 hp, equipped with modern boilers and engines and fairly modern generators. These plants were distributed as shown.

By a consolidation into one large power station, many savings due to the cheap water power, decreased labor, repair expenses and distribution losses were apparent.

A forty-year lease of all the power produced by the dam was effected by the railway company about Jan. 1, 1897. The choice of generating machinery, transmission and distribution plans and equipment was left to the railway company.

TRANSMISSION AND DISTRIBUTION

Without detailing the investigations made by the company, we can say briefly that exhaustive study was made of the most modern electric plants in the country, of most improved methods of transmitting and distributing large blocks of power over long distances.

Given 10,000 hp at the dam, the problem was to convert this power into electrical energy and distribute it to 500 cars scattered over two cities. About sixty of the heavier cars were within a mile of the station. The generation and transmission of 2000 hp for these sixty cars was planned and carried out by using low voltage direct current. This low voltage, 600 volts, is adapted only for short transmissions. It was necessary to send 3000 hp to No. 1 steam station, now known as a sub-station. The distance from the water power station to this sub-station is 1½ miles. For this transmission it was necessary to employ alternating currents and to use a pressure six times as high as that used for the short and ordinary transmission just referred to.

Similarly, 100 hp is sent to No. 2 steam station, now a sub-station. For St. Paul 2000 hp was sent to No. 3 sub-station, formerly the old steam plant, and 2000 to sub-station No. 4, a building and location especially selected for the purpose.

Alternating current apparatus is necessary for economical and structural reasons when we will transmit large blocks of power over long distances. High pressures are necessary in order to reduce the first cost of apparatus and in order to decrease transmission losses.

If you were going to transmit a million gallons of water 1 mile per day, a small-sized pipe and moderate pressure, 60 lbs. per square inch, would be used. If you were to transmit a greater quantity of water and several miles, you *could* increase the size of the main, reducing the friction loss materially. A better plan, however, one involving less first cost, might be to use the small pipe and raise the pressure to, say 1200 lbs., as oil is transmitted in Ohio.

Similarly, in transmitting large blocks of electric power over long distances, good engineering calls for small conductors and high pressure.

The two transmissions to St. Paul were especially long, 7 and 9 miles. It was necessary to use 12,000 volts, an extraordinarily high pressure, in order that the cost of cables and the losses in transmission might be reduced. Twelve thousand volts was the highest pressure heretofore carried for heavy power distribution

† Additional notes on station and other equipments will be found in *American Electrician*, May, 1898; *Street Railway Review*, February, 1899; STREET RAILWAY JOURNAL, June, 1897; *The Electrical World*, Oct. 8, 1898.

in underground cables, and many were the prophecies of failure. One cable, 2 ins. in diameter, was used for each 2000 hp transmitted. Each cable contains three wires, each .4 in. in diameter, separated and insulated from each other and from a lead sheath by common manilla paper impregnated with resin oil, linseed oil and other insulating compounds. The cable is drawn in cement conduit

An attendant is required to supervise the transforming and converting apparatus at the sub-station and to care for the low tension railway distributing switchboards. Copper feeders distribute the power from these switchboards to the different trolley sections. Over 1,200,000 lbs. of copper are required for these local distributions. The current at the car is under the control of the

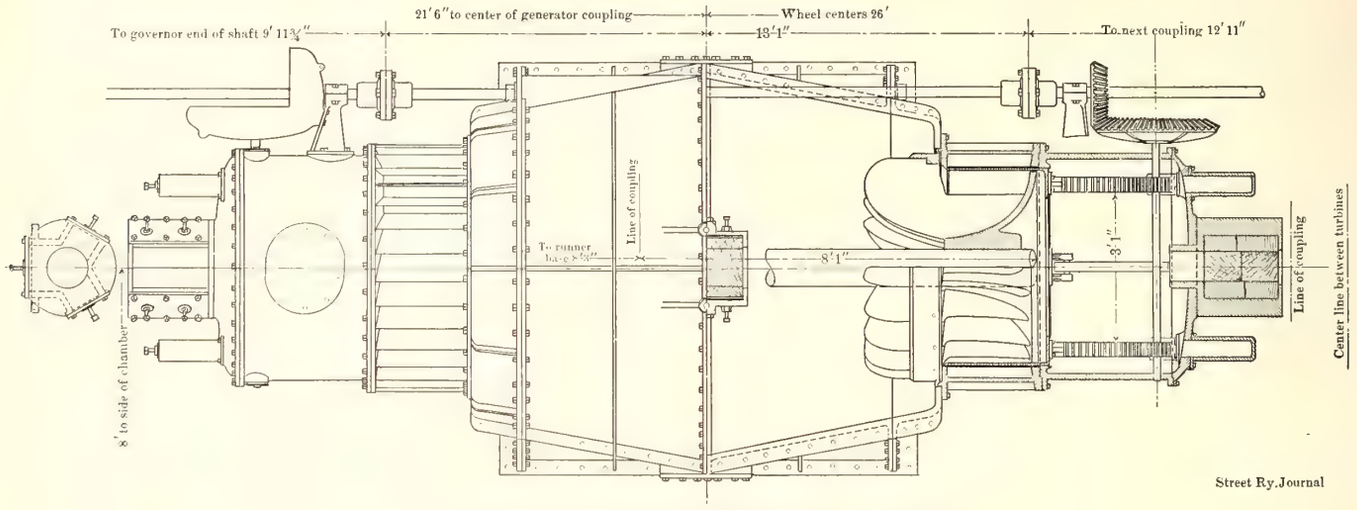


FIG. 7.—REAR 46-IN. TURBINE FLUME AND CASE

ducts 3 ins. in diameter. These ducts are protected by concrete and are laid about 3 ft. below the roadbed. Manholes are located every 500 ft. for the purpose of drawing the cables in the duct, making cable splices and for inspection and repairs. Drawings of cables and splices are reproduced in Fig. 8.

SUMMARY

Reviewing the complete cycle, let us start over again with the water which formerly tumbled down the rapids below St. Anthony Falls. It has been dammed, a pond formed and a fall of 18 ft. produced. The falling water, in passing through the turbines, develops 10,000 hp, which is converted into electric power by the generator attached to the turbine. Direct current of low pressure is provided by two of the 1000-hp generators, while alternating current of moderately high pressure is generated by the remaining eight generators. All the electric power is first carried to a switchboard in the gallery. The operating electrician can start the generation of current, vary the amount, and read from the meters the amount developed. By means of switches, varying amounts are sent to the different sub-stations to meet the changing conditions of load and service. The low voltage direct currents are sent to the nearer lines, especially for the heavy interurban service. Medium pressure alternating currents, at 3500 volts, are sent to the Minneapolis sub-stations, and the extremely high pressures, 12,000 volts, are sent to the St. Paul sub-stations.

It may be interesting to state that the transmission of 2000 hp over 9 miles to the further St. Paul sub-station, at 12,000 volts pressure, is accomplished with a cable loss of but 5 per cent of the power so transmitted.

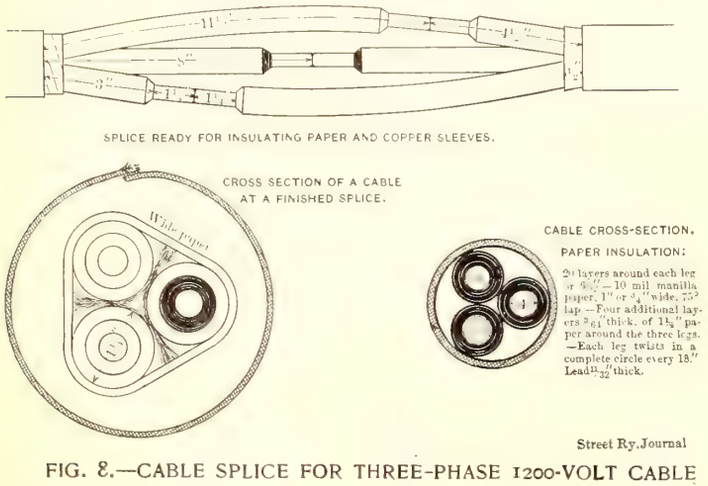

SPLICE READY FOR INSULATING PAPER AND COPPER SLEEVES.
CROSS SECTION OF A CABLE AT A FINISHED SPLICE.
Wide paper
CABLE CROSS-SECTION.
PAPER INSULATION:
Street Ry. Journal

FIG. 8.—CABLE SPLICE FOR THREE-PHASE 1200-VOLT CABLE

At the sub-station the alternating current is reduced in pressure and converted into direct current, after which the sub-station operator sends the power through his local distributing switchboard.

motorman, who uses it for the motors on the trucks beneath the cars.

In this railway system there are three interurban lines; the longest, 22 miles long, between St. Paul and Stillwater, has on the car equipment air brakes, air whistles and arc-lamp head lights. It makes 44 miles per hour, maximum speed; has a schedule of 22 miles per hour. Each car has a telephone used for dispatching cars. Long 10 per cent grades are mounted. All interurban cars are double truck, 44 ft. long, weigh from 18 to 22 tons, and seat fifty-two passengers.

The efficiency of the whole power system is very low. There is a 5 per cent loss due to booms, racks, eddies, etc., near the station, so that we may say the efficiency of the falls is 95 per cent.

	Maximum per cent	Ordinarily per cent
The efficiency of the turbines	80	78
The efficiency of the generators	95	94
The efficiency of the station distribution	92	90
The efficiency of the conversion to direct current	94	91
The efficiency of the local distribution	90	92
The efficiency of the railway motors	80	70

So that of the 10,000 hp developed by the turbines, the railway motors could not get 5900 mechanical horse-power at highest efficiency and not over 5000 hp during ordinary operation. Moreover, 50 per cent of all the power delivered to the motors is spent in acceleration, only to be destroyed in the same block by braking. The motor tractive effort is very high, 25 lbs. per ton, compared with 5 lbs. per ton in steam railroad service.

The cost of the entire power service on this system is but 14 per cent of the total cost of operation of the system.

In closing the lecture, let us consider for a minute the application of an entirely similar system for *steam* railroad service.

The amount of the steam railroad business in this country is not large. The Twin City Rapid Transit Company's passenger service was $2,500,000 last year, while the entire steam passenger service of the country during 1899 is given by one authority as $330,000,000. A far greater problem for the engineer's consideration is the freight business, amounting to $880,000,000 per annum.

The power might be generated by steam or gas engines if water power was not available, but the general plan of the station, the polyphase generators, the transmission, the sub-station and utilization could be quite similar to the system above described.

Many of the steam railroad systems in and radiating from the Twin Cities present quite favorable conditions for the substitution of electricity for steam. This is particularly true where the public appreciates and will use better transportation facilities. By better, we mean faster service, lower fares and more frequent train service. Where these conditions can be worked out, the motive power can be changed from steam to electricity with a resultant decrease in operating expense per passenger carried.

The heavy service on lines in thickly settled districts and between our cities and towns will adopt electricity first, after which the main trunk lines, with their light passenger service, and later

the heavy freight trains will follow, when the management finds electric service is satisfactory as a motive power and in financial results.

The first few years of the coming century will see rapid progress along these lines. Some of the members of the Railway Club will be found engaged in this development.

DISCUSSION

Prof. G. D. Shepardson—Mr. President, there are about three points that I could speak of in which the Twin City Rapid Transit Company has been one of the pioneers.

One is the general adoption of electricity for power. I believe that when the horse cars were finally dropped in the Twin Cities this was the largest electric street railway system in the world. Since that time some of the Eastern cities have exceeded these cities in the number of cars and number of miles of track. This system also I believe is one of the first of the interurban roads, that is, in connecting neighboring cities. Nowadays it is nothing at all uncommon to find electric railway lines connecting neighboring cities. I think at present the longest continuous line in operation is one between Detroit and Ann Arbor, Mich., where there are 40 miles in one stretch. But at the time the interurban road was put in between Minneapolis and St. Paul I believe that was the longest electric railway line in the world.

The other point in which the Twin City Rapid Transit Company has been a pioneer is in the transmission of power at a high pressure for a considerable distance under ground. The speaker of the evening mentioned to-night the difficulties which were expected to arise, but I believe this is the first case where energy has been transmitted so long a distance, at such a high pressure, under ground.

It is a point of considerable interest to know that the telephone people were terribly disturbed lest the high pressure alternating current which was being sent under ground should be a disturbing factor on their telephone lines. This was the only place in the country where they could examine the matter, and the telephone engineers came here from Boston, New York and other Eastern places to examine the system.

So, in at least three particulars, the Twin City Rapid Transit Company has been a pioneer.

I suppose I might add a fourth way, which is not, perhaps, so favorable to railway people, and that is that the vigorous competition between the trolley roads and the steam roads had its effect, and the short line trains were gradually abandoned. That experience has been duplicated in other places since, but I believe that this is the first place where the trolley cars successfully competed with the short line steam roads.

It is interesting to notice that the steam railroad people have adopted the very means which have taken from them a great deal of business, and in quite a number of cases the steam roads have adopted the practice of trolley service on their short lines, with a marked diminution in running expenses and a marked increase in profits. As the speaker said, when we increase the frequency of the service we increase the amount of travel.

The Twin City Rapid Transit Company has been one of the pioneers in other improvements than those already mentioned. About the first instance where street railway feed wires were placed under ground was on Nicollet and First Avenue South in Minneapolis. The "jumper system" of connecting the different sections of the conductors by means of fuses around the circuit breakers was worked out in Minneapolis, the idea having been proposed, I believe, by Mr. Burch; this plan has since been adopted by many large roads, since it reduces the fluctuations of load on the individual feeders as well as upon the power house; it maintains a better pressure upon the lines and thus enables a higher speed to be secured; it reduces trouble at the switchboard and at the power house as a result of the less fluctuation of current, and it is of especial value in case of congested traffic at unusual points. The series-parallel controller, in universal use at present, is the result of the experience of many roads and many men, and it is a matter of some pride that two members of this club, Mr. Burch and Mr. F. W. Springer, of the University of Minnesota, are entitled to the credit for designing the controller which has been in use for a number of years on the Twin City lines and which was practically the first one that proved to be a really successful device; this effected a saving of fully 20 per cent of the power formerly required for operating the cars. I may be pardoned for mentioning in this connection that I had the honor of being the first to discover the true explanation of the curious phenomenon known as "bucking," in which a car suddenly and violently stops as if by a collision; this had been previously considered as a mysterious visitation of Providence that was inexplicable except in a very few cases; by careful examination of a number of cases occurring in this State, the speaker finally located the invariable conditions which caused the trouble and was able to demonstrate a method for making such accident impossible. The safety gates, now so common, were first applied to street cars in Minneapolis, although somewhat similar to those on the elevated roads.

Secretary Foque—Mr. Burch spoke of the generator shaft being extended 2 ft. beyond the bearings, the idea being to eventually put on a vertical direct-connected engine. Is that in case of the failure of the water power?

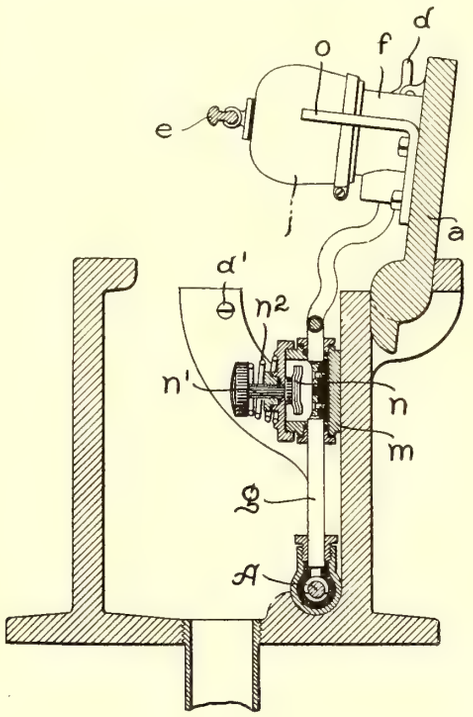
Mr. Burch—When the electric railway traffic and load grow beyond the capacity of the river in winter, reserve engine capacity is needed. The original plan was to have this equipment at the station. It is not probable that this plan for reserve or for additional capacity will be carried out in this way.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED JULY 31, 1900

654,586. Conduit Electric System; F. M. Ashley, New York, N. Y. App. filed Feb. 26, 1898. The invention in general consists of a conduit provided with a removable plate to which the main portions of the working mechanism inside of the conduit are attached. The construction is also such that when the cover



PATENT NO. 654,586

is removed the circuit between the main and sectional conductor is open.

654,868. Electric Railway; G. A. Lyncker, Munich, Germany. App. filed April 23, 1900. This is a sectional conductor system in which the magnets which close the branches between the main conductor and the sections are energized by a battery carried on the car.

654,670. Snow Plow; M. Perreault, St. Thomas de Joliette, Canada. App. filed April 7, 1900. This plow is adapted to lift the snow from the track, divide the mass of snow in two parts and separately discharge the divided mass on opposite sides of the track. The invention relates particularly to the construction of the framework and to the devices for raising and lowering the edge of the plow.

654,803. Trolley Wheel; S. G. Reynolds, Easton, Pa. App. filed Dec. 11, 1899. The wheel consists of a center cored out to receive a felt packing, and removable side discs, the center and discs having interlocking parts and the whole provided with an axial pin adapted to be locked by means of cotters, or otherwise within the jaws of the fork at the upper end of the trolley pole.

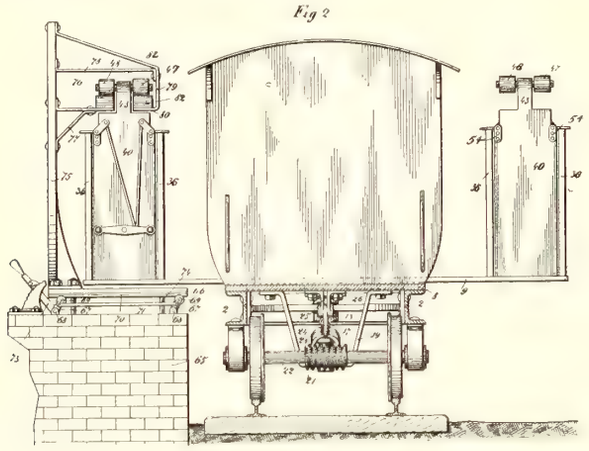
654,805, 654,806, 654,807, 654,808, 654,809. Automatic Brake Shoe or Block; W. H. Sauvage, Denver, Col. Apps. filed Oct. 30. 1899, and Nov. 13, 1899. These inventions are all modifications of the one idea of utilizing the rotary movement of the wheel to apply the brake, the invention consisting specifically of the details of construction of the brake shoe and the rigging.

654,820. Railway Cross Tie; W. M. Woodworth, Sycamore,

Ind. App. filed Feb. 20, 1900. The tie consists of a flat plate having wooden blocks strapped to it, upon which the rails rest.

654,825. Device for Transporting Passengers from and Onto Moving Cars; E. F. Böttcher, Lengenfeld, Germany. App. filed June 10, 1898. The car carries a rotary platform on which rests a number of small cabs. A person or persons desiring to leave the car at a station will step into one of the cabs, whereupon the platform is rotated to swing the cab into line with a receiving rigging built on the station platform. This rigging lifts the cab from the platform while the car is in motion.

Fig 2.



PATENT NO. 654,825

654,854. Car Fender; G. D. Smith, Paterson, N. J. App. filed March 30, 1900. The net is supported in such a way that a body falling into it will cause it to assume a basket shape to retain the body and prevent its rebounding.

PERSONAL MENTION

MR. JOHN SCULLIN, the St. Louis street railway magnate, has just been elected president of the Wetmore Tobacco Company, to succeed Mr. Moses C. Wetmore.

MR. E. S. REILLY, manager of the West End Traction Company, of Pittsburgh, has started for Europe, where he intends to sojourn for about two weeks. Mr. Reilly intends to visit the Paris Exposition.

MR. E. C. FOSTER has not been appointed general manager of the Massachusetts Electric Companies, as reported in the STREET RAILWAY JOURNAL for July 28, but has had his duties increased so that he is now manager of the individual companies controlled by the Massachusetts Electric Companies.

MR. GEORGE L. COOKE, who has been in charge of the Interstate Consolidated Street Railway system for the past six years, has been advanced to the position of superintendent of the Pawtucket Street Railway, and will, in addition, have entire charge. Mr. Cooke succeeds Mr. Charles F. Luther, who was connected with the Pawtucket corporation for more than a dozen years.

MR. CHARLES OLIVER, Chief Railroad and Tramway Commissioner of New South Wales, who has been making his headquarters while in New York with R. W. Cameron & Company, 23 South William Street, expects to sail on Aug. 11. By that time Mr. Oliver hopes to have completed the awarding of contracts for the extensive work being done on the Sidney railway system. The General Electric Company has undertaken the contract for supplying the equipment of the main power station, and it is stated that nearly all apparatus, engines, material, etc., will be furnished by this country. The work is expected to continue for at least two or three years, so that it is quite possible that Mr. Oliver may favor the United States with another visit in the near future.

NEWS NOTES

[*News notes for this department are solicited.*]

DERBY, CONN.—The Derby Street Railway Company has decided to abandon Lake Housatonic Park as a pleasure ground.

BRIDGEPORT, CONN.—The stable of the Bridgeport Traction Company was destroyed by fire Aug. 1. Seven horses were burned to death.

NEW HAVEN, CONN.—At the annual meeting of the stockholders of the Winchester Avenue Railroad Company, July 30, Israel A. Kelsey was deposed as director of the corporation and at a subsequent meeting of the directors Mr. Kelsey was deposed as vice-president, Samuel Hemingway being elected to both positions. Mr. Hemingway is also vice-president of the Fair Haven & Westville Railroad. Henry S. Parmelee was re-elected president, Henry F. Spencer secretary, and Albert E. Pond, treasurer and superintendent. The following directors were elected: Henry S. Parmelee, S. Harrison Wagner, Albert E. Pond, Henry F. Spencer, Samuel Hemingway, John B. Carrington, E. Hayes Trowbridge, George D. Watrous, James S. Hemingway.

WASHINGTON, D. C.—The Washington Traction & Electric Company has just completed the extension of its lines from North Capitol Street via Michigan Avenue to the Catholic University, where connection is made with the old Brookland Street Railway. The cars are now run from Penn Depot to Brookland over the new route, and its city lines. The use of the tracks from Albany Street to the Catholic University has been discontinued at least for the present. Work is rapidly progressing on the rebuilding of the Washington Traction & Electric Company's tracks in Eckington.

SAVANNAH, GA.—It is said that the Savannah, Thunderbolt & Isle of Hope Railway Company will shortly make application to the City Council for permission to lay a second track on Barnard Street, and two switches on Whitaker Street. This action will be preliminary to a change in the operation of the lines.

CHICAGO, ILL.—While going north in Superior Avenue, South Chicago, a few nights ago an electric car of the South Chicago City Railway left the track and ran on the sidewalk in front of 8421 Superior Street, demolished the car and injured two passengers.

CHICAGO, ILL.—Traffic on the Metropolitan Elevated during July showed a daily average of 73,790 passengers, as compared with 67,498 during the corresponding month of last year. This is a gain of 6292. The gain is small, and this is due to the labor troubles, which have had a severe effect on West Side travel. The traffic by months, with a comparison for 1899, follows:

	1899	1900
January	72,338	88,585
February	75,344	92,618
March	79,243	94,508
April	77,464	90,430
May	75,890	86,288
June	72,433	82,206
July	67,498	73,790

CHICAGO, ILL.—The Appellate Court has sustained the decree of the Circuit Court, made in July, 1897, ordering the sale of the Alley L elevated road and its appurtenances and the division of the proceeds between the two mortgages. There were no new legal points covered, and the decision is of importance only to the stockholders of the company operating the road, whose title is strengthened. The Chicago and South Side Rapid Transit was built in two sections, the first section extending from Congress Street to Sixty-Third Street, and the second section from Calumet Avenue to Stony Island Avenue, along Sixty-Third Street. To pay for the construction of the first section bonds to the amount of $7,000,000 were issued, and secured by a trust deed on the section, made to the Northern Trust Company as trustee. To pay for the construction of the second section bonds to the amount of $3,000,000 were issued, and secured by a trust deed on both sections, made to the Illinois Trust and Savings Bank as trustee. On default of interest the Northern Trust Company asked foreclosure of the first mortgage on the first section, and the next day the Illinois Trust and Savings Bank filed a cross bill for the foreclosure of the blanket mortgage on both sections. The court ordered the property sold, the proceeds to be divided between the two sets of bondholders, in the proportion of 75-93 to the first set and 18-93 to the second set. The property was bought in by the bondholders and divided between them in that proportion. The stockholders of the original company claimed that the whole bond issue was void; that the franchise forbade any company but the original one ever to own the road, and that the practical result of the foreclosure was to wipe out and destroy the property interests of the stockholders in the original company.

CHICAGO, ILL.—South Side Elevated traffic during July showed a daily average of 60,972 passengers, as compared with 52,644 for the corresponding month of last year, or an increase of 8328, equal to 15.8 per cent. The record is the smallest this year up to the present time, as July is a poor month for elevated road travel. The record so far this year, with a comparison with 1899, follows:

	1899	1900
January	58,762	69,504
February	60,292	70,050
March	63,909	72,264
April	63,878	71,665
May	50,588	68,296
June	56,117	67,892
July	52,644	60,972

ANDERSON, IND.—The perversity of a citizen of Summitville resulted in a funny legal complication a few days ago. The citizen in question having received a permit to move a house, proceeded with the work in the day. In its course the house was to cross the tracks of the Union Traction Company, and as soon as the officials of the company were advised of the movement they obtained a restraining order. The order was served just as the house was crossing the tracks, and the men when served with the notice immediately quit work, and left the structure on the tracks. The company then brought mandamus proceedings, and the court ordered the building taken away, but the men refused because lawyers advised them that the restraining order had not been dissolved. The company went with a force of men to remove it, but were stopped by the citizens. Passengers were transferred around the house, from one car to another, until the legal difficulties were overcome.

INDIANAPOLIS, IND.—The interurban electric railways entering this city still protest against the provisions of the franchises offered them by the city. The objections are against the clauses which require universal trans-

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

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Annual Meeting of the Pennsylvania Street Railway Association Postponed

The annual meeting of the Pennsylvania Street Railway Association has been postponed until Oct. 10 and 11, and will be held at the Neversink Mountain House, Reading, Pa.

New York Convention Postponed

The eighteenth annual convention of the New York State Street Railway Association, which was to have been held at Buffalo Sept. 11 and 12, has been postponed until Sept. 18 and 19, at the same city. The postponement is made because of lack of hotel accommodations for the week commencing Sept. 10, as a number of other conventions are scheduled for this city at that time.

Municipal Ownership Ordinance Drafted for St. Louis

The Board of Public Improvements has drafted an ordinance, to be presented in Council, which provides that the city operate by electricity the railway extending from the Baden station of the waterworks to the Chain of Rocks. The road, at present, although owned by the city, is operated as a branch of the Burlington Railroad, and is used exclusively to transport the necessary heavy freight between the two branches of the waterworks system. The ordinance also provides for placing regular passenger coaches on the line, and for their regular operation by the city in competition with the private city lines in the vicinity.

Transfer Privilege to be Curtailed in Washington

It has been announced that the Washington Traction & Electric Company will make a number of very important changes in its transfer system, to take effect Aug. 15. A new transfer schedule has been arranged, but the most important change is that which abolishes the double transfer. Hereafter a transfer will not be issued on a transfer, but only when a cash fare is paid.

Before the consolidation of the roads now comprising the Washington Traction & Electric Company, no transfers were exchanged except between the Metropolitan and Columbia railways, and in some cases it required three fares to go from one point in this city to another. The consolidation of the separate lines and the issuance of transfers on transfers made it easy for a passenger to start from and return to a given point on one cash fare. In order to prevent this "looping" the company later required the passenger to state, at the time of paying his fare, at what point and in what direction a transfer was desired. Failure to comply with this order forfeited the right to a transfer.

New Haven Company Establishes a Precedent

On Aug. 1 the Winchester Avenue Railroad Company, of New Haven, Conn., issued an edict which prohibits passengers from riding on the running board of a car or from standing between the seats of a car on its system. This is an entirely new departure in street railroading, and the outcome will be watched with great interest throughout the country. The conductor is given to understand that just as soon as all the seats in the car are filled he must refuse to take on even one more passenger until a seat is made vacant by a passenger getting off. It must be said, however, of the new ordinance that it is a little severe on the motorman. He is required to keep a sharp lookout and to know when there are no vacant seats. As soon as his car is full, he is to proceed until signalled by the conductor to stop, or in case of an emergency. If passengers be waiting for the car, he is to slow up, not stop, and request them to wait for the next car.

A Unique Accident

A motorman working on the Waukesha interurban line of the Milwaukee Electric Railway & Light Company, and who wore celluloid collars because they were inexpensive, was seriously injured a few days ago because of his efforts to reduce his laundry bills. On Aug. 5 he noticed that his car was wrong, and, leaning over to adjust the switch, he turned on the current. Suddenly there was a flash and a spark flew out from the controller box. The motorman's collar was a shining mark, and it was ablaze before he realized what had happened. Before he could tear it from his neck, a broad band had been burned around his throat, his hair and eyebrows had been singed, and his hands burned by

the melting celluloid, which clung to his fingers. It was necessary to take the man to the hospital. Largely, it is said, on account of this accident, President Roach, of the Union Traction Company, of Chicago, has issued an order prohibiting his men from wearing celluloid collars, and it is thought that motormen in other cities who have worn this material will hereafter discard it for the more easily soiled but less combustible linen.

An Interesting Opinion in a Bicyclist's Suit

A most interesting opinion has recently been written in the case of Bacon vs. Consolidated Traction Company by the judge of the Court of Common Pleas, Allegheny County, Ill. The facts were that the plaintiff, an inexperienced bicyclist, rode on to the tracks, when a car proceeding on a down grade was "right behind him," and started to ride a distance of about 160 ft. and then turn off from the tracks. Just as he was turning off, after having gone about 140 ft. without having looked back at the car, he was struck by the car with the result, as the judge says, that "he was whirled in the air and came down, doubtless on the ground." The judge dismissed the suit for damages brought against the car company, on the ground that the plaintiff "was guilty of negligence, gross negligence, absolute recklessness." The judge then went on to say: "I have long been impressed with the belief that the courts should take a firm hold of these cases, where men risk their own lives by just going before a car or traveling on a track before a car. If the plaintiff can be sustained in this action, the result of it is about this, that these bicyclers can get on to the track of a street railway, plod along on that track, and expect that the motorman of the car behind will stop to let them off rather than hit them, and if that is the law with these bicyclers, perhaps one-half the cars in the city will be delayed in their trips. Some of these young fellows and others run before the car and expect the car to stop while they get out of the way. They should get out of the way without that. They should keep out of the way, and not run the risk of an accident." Finally, and apparently in the interest of humanity, the judge concluded his opinion with these words: "It is almost a wonder that this man was not killed by that accident, and by sustaining his right to recovery here I think it would result in somebody else being killed; it should rather be a warning to these bicyclers to keep off the tracks when they know a car is coming and avoid those dangers."

Early Opening of the Stephenson Plant

Joseph C. Willetts and Adolph Wimpfheimer, purchasing committee of the newly incorporated John Stephenson Company, have taken title to the plant, equipment and material of the late John Stephenson Company, Ltd., at Bay Way, near Elizabeth, N. J. Peter M. Kling, the general manager, is in charge, and will soon have the works in active operation. The officers of the new company will shortly be chosen.

Outing of Metropolitan Street Railway Officials

On Aug. 11 President Vreeland, of the Metropolitan Street Railway Company, of New York, entertained all the heads of the departments on that road at a clambake and reception at his country home in Brewster, N. Y. This is the second of a series of such entertainments extended by Mr. Vreeland, the first having been given about a year ago, and typifies the cordial friendship existing between the president and personnel of this large company.

The guests left the Grand Central Station about 9 o'clock on special cars attached to the Pittsfield express. After their arrival at Brewster, they were taken by carriages to the clubhouse of the Tonetta Outing Club, of which Mr. Vreeland is a member. The Brewster cornet band gave a concert, after which the Rhode Island clambake was eaten, some fishing was enjoyed, and the party again entered the carriages and was driven to Rest-a-While, the Vreelands' country home. Here they were cordially received by Mrs. Vreeland, who was assisted in receiving them by a number of ladies living in Brewster. In a speech of welcome Mr. Vreeland spoke feelingly of the support the employees had always accorded him. Responses were made, and he was assured of the esteem and regard in which he was held. Luncheon was served on the lawn, under the personal supervision of Mrs. Vreeland, the lawn being brilliantly illuminated, and the party returned to New York by special train.

Among those present from the company were: D. B. Hasbrouck, vice-president; Charles E. Warren, secretary; H. S. Beattie, treasurer; directors, H. P. Whitney, Thomas F. Ryan, W. L. Elkins, Thomas Dolan, P. A. B. Widener and H. A. Robinson; also, F. S. Pearson, consulting engineer; M. G. Starrett, chief engineer; W. B. Reed, engineer maintenance of way; W. A. Pearson, electrical engineer; F. Greenwald, track master; Thomas Millen, general master mechanic; A. C. Tully, purchasing agent and general storekeeper; A. V. Porter, architect; D. C. Moorehead, general auditor; Frank Kane, chief of gripmen; George Brown, chief of switchmen; George Robinson, general car-house foreman; Oren Root, Jr., assistant general manager; James Parker, chief inspector, and a number of the division superintendents and general foremen.

Among others in attendance were: W. W. Wheatley, general superintendent, Brooklyn Rapid Transit Company; W. W. Snow, president, Ramapo Iron Works, Hillburn, N. Y.; D. M. Brady, president, Brady Brass Company, of executive committee, New York Railroad Club; Edward W. Maher, president, Union Railway system, New York; G. Tracy Rogers, president, Binghamton Street Railroad Company; John Beaver, treasurer, Third Avenue Railroad Company; J. H. Hustis, superintendent, New York & Harlem Railroad; H. A. Macdona, and J. H. McGraw, of the Street Railway Journal.

Accident Instructions in Ithaca

H. S. Cooper, general manager of the Ithaca Street Railway Company, of Ithaca, N. Y., has recently issued to his conductors and motormen a comprehensive set of instructions as regards accidents. The instructions are in book form, and each copy is numbered. A list is kept of the copies issued, and each recipient is obliged to sign a receipt promising to return the book to the company when leaving its employ, or on request.

The pamphlet contains the telephone numbers and addresses of the different offices and officials of the company.

A special effort was made by the management to make the instructions full, explicit and *legal*, and for this reason they are given below as being possibly of help to other companies who issue instructions of this character.

INSTRUCTIONS

These "Instructions" are the exclusive property of the Ithaca Street Railway Company, and are issued solely to the employees of this company for their information and guidance while in the employ of the company. When employees to whom they are issued leave the service of the company, these instructions *must* be returned to the office of the company. All employees are forbidden to give, lend, sell or show these instructions to *anyone*, or to communicate any part of the contents to any person not regularly in the employ of the company. General Manager.

Every disturbance on, or occasioned by the cars, every collision or derailment, every accident to individuals or to animals, vehicles or property not belonging to the company, if such occurrence is caused by the cars, by their operation or by the act or operation of any employee of the road when engaged in duties for the company, *must* be reported to the office in some way.

Accidents to the car or its machinery, to track, bridges, or overhead line, derailments and collisions, loss of power, any and all of the foregoing which delay a car sufficiently to make it "lose its time" and which do *not* result in any injury to individuals or do *not* affect property belonging to outside parties, must be reported on the back of the car report in the form arranged for it.

Accidents which involve the *slightest* injury to any individual or the *slightest* chance of a *claim* for injury *must* be reported at once on the regular "Accident Report" of the company in the manner as prescribed further on. Accidents which involve any animals, vehicles or property *not* belonging to the company *must* be reported on the same form and in the same way. All disturbances on or occasioned by the cars, all ejections, no matter for what cause, must also be reported on this form.

In the matter of accidents to individuals, it must *never* be assumed that "no harm has been done," no matter what the individuals say themselves. The assumption must always be that "harm *has* been done" and the report must be as promptly and accurately filled, and names of witnesses, etc., taken with as great care as if actual and visible injury had been inflicted. Much loss has been occasioned to companies by the neglect of employees to properly report cases of accidents which seemed trivial at the time of occurrence but which developed into important and expensive cases. The invariable rule must be: *To report every accident to individuals with full and equal care.*

(1) Upon the occurrence of any accident the *first* duty is to render assistance to the person or persons involved in it. In case of bodily injury they must be taken or carried to the nearest hospital, doctor's office, drug store, store or dwelling and a doctor summoned at once. The instant that a doctor or other competent person (such as a nurse or relative) arrives, the injured person will be left in their charge and you will at once proceed to fulfil your other duties in the matter.

In case of accidents to animals, vehicles or other property, any needed assistance *must* be given to the riders, drivers or owners.

(2) The *next* duty is to obtain the *full and correct name and address* of the person or persons injured or of the riders, drivers or owners of animals, vehicles or property injured or damaged.

(3) The *next* duty is to obtain the *full* and *correct names and addresses* of all bystanders and eye-witnesses. If the accident is on or caused by a car, the name and address of *every* passenger must be obtained. For this purpose, the "witness slips" will be distributed to *every* passenger and to *every* bystander, and they must be politely asked to "please write their full name and address on them and give them back to you." If they refuse to do so, or seem very unwilling to do so, you will urge them to do it, or will ask them to give you their name and *you* will put it down. If they still refuse, or seem unwilling to give their names, tell them that it is a strict rule of the company and that your failure to obtain their names and addresses will be a detriment to you, as your failure to obtain names of witnesses will look as if you had not tried to obey the rules of the company. In case you are then unable to obtain their names and addresses you will, in case they were passengers or bystanders who you are pretty certain were witnesses of the accident, try if others around know them or can give you their names, and if such information cannot be obtained, you will take good notice of them so as to be able to recognize them at any time in the future. Every effort *must* be made to obtain *the names and addresses of all possible witnesses;* it is better to obtain a hundred useless ones than to miss a single person who *was* a witness of the event. In this matter the operation of the car *must be a secondary matter;* the motorman will remain with and in the car, unless he is incapacitated by injury or unless his assistance is absolutely necessary with the injured, and he will then go only a short distance away, and will, before leaving the car, make certain that the brake is on tight, and will throw the overhead switch and controllers to "off" and take both controller handles with him. In case, however, of another motorman or conductor being on the car or coming to it, he will leave the controller handles and care of the car with him. In no case must the car be started until the above duties have been fulfilled, unless relieved by the arrival or the direct orders of the starter, inspector, general manager or corporation counsel.

(4) The *next* duty, in case of actual bodily injury, is to notify the officers of the accident by the *quickest possible method.* If the office is closed, the general manager, corporation counsel or inspector *must* be notified wherever they can be reached or found. All employees are empowered to go to any necessary expense for telephone charges or special messengers for this purpose and the numbers of all company telephones and the addresses of the above persons are attached herewith for your information.

(5) The *next* duty is to make out the report. When the corporation counsel or his assistant is in his office or when they can be reached in any way, the report will be made out under their supervision and will be sworn to at once. In cases of bodily injury, where the above parties are absent from the office or cannot be reached, the report must be filled out *under the supervision of the inspector or general manager.* As one of the objects of the report is to fix the facts while they are fresh in the minds of those concerned in the event, *it is necessary that the report be made out as soon after the event as possible,* and therefore employees concerned in any accident, etc., will be immediately excused from their regular duties in order that they may make out such report. The other object of the report is to obtain ALL THE FACTS EXACTLY AS THEY OCCURRED. For this reason, opinions and "hearsay" are *not* wanted in it, what *is* wanted is for each employee to tell truthfully and exactly what he did and said and what he saw and heard others concerned do and say, *not* overlooking any detail, however trivial, *not* making excuses for or glossing over any forgetfulness or carelessness on his part or the part of anyone else, simply giving THE FACTS, ALL THE FACTS, AND NOTHING BUT THE FACTS as seen and heard and done by himself. The following instructions from the accident report should be carefully read when making out the report and the provisions *exactly* followed.

"NOTE.—Read the following instructions carefully before filling the above space. In case of accident, however slight, by which persons or property are injured, communicate at once with the office, by telephone if possible. Render all possible assistance to the injured, and at once obtain names and addresses of persons in car and other witnesses to the accident. In making this report, a separate report is to be made out by the conductor and motorman, and their position on the car at the time of accident should be shown. State clearly and briefly just what occurred, as you saw it. State conditions of weather and any obstacle which obscured your vision. State fully the nature of injury to persons or property. Give your reasons why you could not prevent the accident, and state what you did to prevent it. State whether person injured was lame, deaf, intoxicated or of defective vision; and give his or her approximate age. If property was injured, describe condition of property. State any act done by the person injured or whose property was injured, or any circumstances connected with such person, which in the slightest degree contributed to the injury. State what, if anything, was said by the person injured immediately after the accident, and give such further information as you may deem important. Avoid making any statement concerning the accident to outside parties."

(6) The *next* duty is to report for your regular duties and HOLD YOUR TONGUE! Under *no* consideration must the matter be discussed with or any information given to anyone outside of the proper officers of the company. *No excuses or accusations must be made or refuted at the time of the accident nor afterward.* Relatives, friends, fellow-employees, lawyers, reporters and the general public who try to obtain information from you in regard to the event *must* be informed that for you to discuss it *at all* or to give *any* information in regard to it is *positively forbidden* by the rules of the company, and they *must* be referred for such information to *the proper officers of the company.*

To recapitulate:

1. Render necessary assistance.
2. Obtain full and correct name and address of person or persons injured, or of riders or drivers or owners of animals or vehicles or property injured.
3. Obtain full and correct name and address of all possible witnesses.
4. Notify office or officers.
5. Make out report.
6. Report for your regular duties and hold your tongue.

6a. KEEP ON HOLDING YOUR TONGUE!

EJECTIONS

Passengers will be ejected from a car only as a last resort, when all other means have been tried and have failed, and when the conductor is *positively certain* that he is in the right.

Ejections must be made for the following reasons only:

1. Intoxication.
2. Personal offensiveness to the other passengers.
3. Refusal to obey rules of company.
4. Refusal to pay proper fare.
5. Disorderly conduct.

(1) Persons who are *visibly* intoxicated must not be allowed to get on the car. If, however, such a person has entered the car without his condition being noticed, he may, if his condition is not offensive and if he remains orderly, be carried to his destination. If this is done, care must be taken to see that he does not get off the car while it is in motion, and, when he is let off, care must be taken to see that he is entirely free of the car before it is started. Should his condition be complained of as being "offensive" by other passengers in the car, or should his conduct become "disorderly" he must be treated as ordered below.

(2) Any person who is complained of by the other passengers as being personally offensive and who is, in the judgment of the conductor, *actually so,* must be *quietly* asked to leave the car. Should they object or resist, they must be treated as disorderly persons, as below.

(3) Persons who persistently or continually refuse to obey the rules of the company after same have been brought to their notice, must be treated as disorderly persons, as below.

(4) In case of persons who absolutely refuse to pay the proper fare or give the proper ticket, the conductor will have to exercise discretion. When the person is a respectable woman or man who is sober and of respectable appearance it is generally best to carry such persons to their destination or to their transfer point, taking their name and address, their reason for nonpayment of fare or ticket, and in *every case* reporting the occurrence *in writing* to the office. When, however, any person shows plainly that it is their intention to "beat their way," they must be treated as disorderly persons, as below.

Persons giving a wrong transfer or one which is past time for proper use, must be asked to pay their fare and informed that if the transfer has been wrongly punched or given, it will be redeemed at office of the company on presentation and explanation. Should they persistently refuse to pay their fare, the transfer will be

accepted as fare, will *not* be rung up, but will be turned into the office with a *written* report of the occurrence and the name and address of the person presenting it. In no case must a person be ejected for presentation of a wrong or past-due transfer unless the conductor has *positive* proof that they are trying to "beat their way."

(5) Disorderly conduct consists of the above as stated, of violent or unseemly actions, of quarreling and fighting, and of abusive, threatening, profane or indecent language or actions. In all such cases the conductor will quietly and civilly request the disorderly persons to discontinue their conduct. Should this *request* have no effect, he will, still civilly and quietly, *tell* them to discontinue their conduct or leave the car. Should this be of no avail, the car must be stopped, at a street corner if possible, and the person asked to get off. Should they refuse to do so and a policeman be within call, he must be called and asked to remove the person. Should no policeman be within call, or should he, if called, refuse to remove the disorderly person, the motorman must be called on and the person ejected.

In all cases of ejections the car must *first* be brought to a *full stop*, at a street corner or regular stopping place if possible, and always at a *safe place* for a person to alight. If the person has paid their fare or given a ticket or transfer, the same will *always* be *publicly* tendered them BEFORE EJECTION.

No more force must be used than is necessary to remove them from the car, *no blows must be struck nor weapons used* by either conductor or motorman except in absolute defense of themselves or their passengers. In case the person voluntarily leaves the car or shows that they are willing to do so, no hand must be laid on them, except to assist them in case they are unable to get off without assistance.

No ejectment must ever be made of a child or a respectable woman. No ejectment must ever be made of any respectable appearing or sober man during a storm or at night in a dangerous or disreputable location.

In all cases it is necessary that the conductor feel *certain* that he is right beyond question before he proceeds to final measures, he *must* keep his temper and his presence of mind. While it is his duty to preserve order and decency on the cars, to see that people do not cheat the company, and to see that the company's rules are strictly obeyed and its property protected, it is best, if there is any doubt in his mind as to his being in the right, to carry such persons to their destination or to some point where he can obtain aid or advice.

In all cases of ejection the *conductor has entire charge and responsibility.* If the disorderly conduct is against the motorman or if seen or heard only by him, he will call the attention of the conductor to it and abide by his decision and orders. He will at all times aid the conductor when called on to do so or when he sees, hears or knows that his aid is required.

In every case of ejection a full report must be made out, the same as in accident cases. Equal care must be taken to obtain names and addresses of witnesses and in all cases of ejection it is best, *if it is in any way possible,* to make the ejection in the presence of witnesses.

Some Notes on Train Resistance.*

BY T. LESTER DANIEL, UNIVERSITY OF MINNESOTA

The subject of train resistance is one of two-fold interest to the railway mechanical engineer of to-day. It is of interest first because of its close relation to tonnage rating, and second, because of the direct saving in expenses accruing from its reduction. The Lake Shore & Michigan Southern Railroad, in 1873, figured that $785,000 a year could be saved by reducing train resistance 25 per cent, but in spite of the incentive to effort in this direction train resistances are the same to-day that they were then, because, undoubtedly, railway men are too busy to go beyond the routine of their regular work, certainly not because perfection in this respect has been reached.

It seems as though a reduction of 25 per cent were easily within the range of probability, inasmuch as Wellington (Trans. A. S. C. E., April, 1873), has shown that a reduction of 85 per cent in axle friction could be made by substituting oil bath lubrication in place of the common pad lubrication now in use, and when it is considered that axle friction constitutes by far the largest part of train resistance, and that there is further chance for its reduction by changing bearing metals, proportion of journals, and quality of lubricant, it is seen that there is opportunity for considerable improvement, to say nothing of the saving that might be made in the imperfectly understood rolling friction.

Tonnage ratings could be made much more accurately with a better knowledge of the factors composing train resistance, for a knowledge of the factors as well as the sum total is essential, as can be seen from the following: The proceedings of the Western Railway Club, February, 1900, cite an instance where a rise in temperature lowered the resistance 24 per cent, and the C., B. & Q. Railroad tests (*Eng. News,* 1888, p. 409) show that a strong side wind increases the resistance 60 per cent. The above number of the proceedings of the Western Railway Club also records an instance where a train of empty cars pulled harder than a train of loaded cars by .7 per cent per ton, and these factors, *i. e.,* empty cars, temperature and wind, have received so little attention that they have never been incorporated in the common formulas for train resistance. Obviously, a better understanding of these would result in a much more satisfactory tonnage rating.

Train resistance is generally expressed in pounds of draw-bar pull per ton of weight hauled on a straight and level track; it amounts to about 6 lbs. at 10 miles per hour, and 16 lbs. at 60 miles per hour; it is seen to increase with the speed, which is in accordance with the well-known experimental laws of friction. In colder and windy weather the few isolated observations that have been made indicate that the resistance would be larger, and many other changes besides that of velocity might be imposed affecting the result, but unfortunately experiments have been restricted almost entirely to velocity variation, as illustrated in the following typical formulæ:

Clark, $R = 6 + \frac{M^2}{240}$

Baldwin Locomotive Works, $R = 3 + \frac{M}{6}$

J. B. Blood, $R = 4 + .15\,M + .3\frac{M^{1.8}}{T}$

(Street Railway Journal, March, 1899.)

in which R is the resistance in pounds per ton; M, speed in miles per hour; and T, the tons hauled. These differ quite materially in form, although they all give reasonable results. Many others have been proposed, but probably none give better results than that of Blood. He has a term increasing with the 1.8 power of the velocity, which seems reasonable, for it harmonizes with experimental laws. Laws of solid friction state that it varies directly with the first power of the velocity, while laws of fluid friction state that it varies with the square of the velocity. Now, in case of car journals, we have neither a case of solid nor a case of fluid friction, but a case of mixed friction, and it seems reasonable that it should partake of the nature of both solid and fluid friction, and that its exponent should be neither 1 or 2, but some intermediate value. This term also decreases as the tonnage increases; this agrees well with the admirable experiments made by Thurston, where he shows that, within the limits of railway practice, the coefficient of friction decreases as the pressure increases.

The fact that different experimenters obtain different results is no particular cause for distrust; it means that experiments are carried on under different conditions, and until uniform conditions are prescribed and accepted uniform results cannot be expected; different conditions of lubrication, or different lubricants, may be responsible for the resistance varying anywhere between the first and second power of the velocity, for the magnitude of this kind of friction is determined by the nature, quantity and method of applying the lubricant. The condition of bearings, condition and size of wheels, condition of rails and roadbed, also affect the result, together with temperature, wind, number of cars, velocity, grades, acceleration, air friction and curvature of track.

The resistance due to curvature depends on its compensation, elevation of outer rail, kind of couplers, whether rigid or flexible head, length of wheel base, and probably upon the kind of trucks used. Formulæ proposed at different times for some of these factors are:

Acceleration, $R = .0132\ V^2$

Rolling, axle and air friction, $R = 4 + .15\,M + \frac{M^{1.8}}{T}$

Grade, $R = .38\ G$

Curvature, $R = .438\ D$ (at 25 miles per hour)

where R = resistance in pounds per ton, M = miles per hour, T = tons hauled, G = grade in feet per mile, D = degrees curvature, and V = speed attained in one mile, in miles per hour. Air friction amounts to about 4.2 lbs. per car; assuming a loaded car to weigh 45 tons, this amounts to .093 T = R; rolling friction is generally taken at 1 lb. per ton (Trautwine) and is due to the rail resisting the progress of the wheel.

The increased resistance due to curvature at a velocity of 25 miles per hour has been analyzed as follows (Trans. A. S. C. E., April, 1878):

* Paper read before the North-West Railway Club, May 15, 1900.

Due to twist of wheel.....	.001	lbs. per ton per degree
" slip of wheel.....	.1713	" " "
" flange friction.....	.2450	" " "
" loss at coupling....	.0213	" " "
Total.....	.4386	

The "coning" of wheels increases this from .125 to .25 lbs. per ton per degree; loose wheels reduce this loss 20 or 25 per cent.

The increased draw-bar pull due to tonnage made up of empty cars is partially due to increased air friction and partially due to increased co-efficient of friction at lighter pressures. (Thurston, "Friction and Lost Work in Machinery and Mill Work," p. 304).

The following results for train resistance were obtained from a dynamometer car test made by the Minneapolis, St. Paul & Sault Ste. Marie Railway last winter, and while the results are not as uniform as could be wished, they are as satisfactory as those usually obtained:

No.	Pull in Pounds	Mile Post	Grade in Feet to the Mile	Resistance in Lbs. Per Ton	Miles Per Hour	Remarks
1	24,000	44	42	5 16	6.5	
2	25,000	45	42	6.05	5.8	
3	25,500	48	28	11.8	2	All cars on 4° curve
4	25,750	48.59	42	6.66	4.1	
5	11,000	59.5	Level	9.66	15.3	
6	11,750	68	7.67	7.41	19.8	
7	8,200	70.25	Level	7.2	20.5	
8	5,700	89.75	Level	5.01	26.5	
9	8,100	92.31	Level	7.11	22	
10	24,200	102 32	42	5.35	8.1	
11	28,000	103 4	42.2	8.6	4.9	
12	11,250	109.5	3.69	8.5	19.2	
13	6,900	118.66	Level	5.41	24.4	
14	7,200	126.4	Level	5.64	26	
15	24,250	133.19	42.2	4.76	8	
16	19,100	133.49	29	3.92	9.5	
17	7,400	136.62	Level	5.8	24.7	
18	10,560	141.11	5.28	6.26	20	
19	15,100	146.63	14.72	6.25	17	

The train consisted of thirty-five loaded cars, with a total weight of 1139 tons, tare 474; at Weyerhaeuser (Mile Post 114) the train was increased to thirty-nine cars, 1277 tons. Results were deduced from the draw-bar pull, P, and the grade, G, and the tonnage, T, by the following relation:

Work per mile $= P \times 5280 = Rt \times 5280 + 2000\ G\ T$ where the work is expressed in foot-pounds and Rt is the total frictional resistance due to axle, rolling and air friction; solving for Rt we have

$$Rt = P - \frac{200\ G\ T}{528}$$

Dividing this by the tons hauled gives the resistance in pounds per ton as tabulated in column five; these correspond closely to the formula $R = 5.25 + .072\ M$ where R is the resistance in pounds per ton and M is the miles per hour. As can be seen, the run was made with a freight train and with a small range of velocities, 2 to 27 miles per hour.

In order to ascertain in any case if the tonnage is so large as to produce frictional resistances beyond the capacity of the locomotive, all the various resistances, rolling, axle, air, grade, curvature, etc., as given above, are added together, giving Rs the sum of all the resistances for the particular place in mind; then the draw-bar pull, P, required is found from

$$P = Rs\ T + \frac{G\ T}{5280}$$

which may be compared with the known pull which the locomotive can exert. If the train can have a speed, M, at the foot of the upper grade, it may ascend a hill steeper than that given by the above, *i. e.*,

$$= \left(\frac{P - Rs\ T}{T}\right) 5280,$$

for its momentum makes it capable of climbing a grade considerably beyond the apparent capacity of the locomotive. The force due to this momentum is found as follows:

Momentum $= mv$, where $m =$ mass of train $= \frac{\text{weight in lbs.}}{32.2} = \frac{w}{g}$;

and $v =$ velocity of train in feet per second. Now $v = at$, where $a =$ acceleration in feet per second and $t =$ time in seconds to acquire the velocity v, hence, $mv = \frac{w}{g} at$; but force $= f = ma = \frac{w}{g} a$;

therefore, $ft = \frac{w}{g} at = mv =$ momentum, and $f = \frac{mv}{t}$ where f is the force due to the momentum of the train of mass $m = \frac{w}{g} = \frac{t}{g} \times 62.3$ moving with a velocity v for t seconds. Reducing this to more convenient numbers for our purpose it becomes $f = \frac{T\ M}{t} \times 2.83$,

where f is the total force in pounds, T is the tons hauled, M=miles, per hour and t=time in seconds to ascend the grade; representing the length of the grade by L miles and taking the velocity at the foot of the grade at 30 miles per hour (for freight trains) t becomes equal to $\frac{2\ L}{30} = \frac{L}{15}$ and $f = \frac{T\ M\ L}{15} \times 2.83$ and the average force on the grade $= F = \frac{f}{2} = \frac{T\ M\ L}{30} \times 2.83$, hence the grade that can now be ascended is $G^1 = \frac{(P+F-Rs\ T)\ 5280}{T}$ where G^1 is in feet per mile.

Results of experiments up to date enable me to make such computations with very fair satisfaction for certain normal cases, but much further experimentation is needed, as the laws of train resistance are still unformulated.

"Every Ohm, Volt and Spark to be Registered"

When the average daily newspaper reporter undertakes to describe an electrical device he usually falls into many pitfalls, and his account is most fearfully and wonderfully made, but the following article from the Philadelphia *Evening Telegram* of Aug. 7 is one which would be hard to beat:

"The wattmeter is the latest addition to the duties of the trolley motorman, and is regarded by that individual as the most exacting of all the things he must keep under his eye, although in this instance he must keep it under his feet and never fail in doing so. If he does it ceases to work, and the object of the wattmeter is continuous work, for it measures the electric current and saves power.

"Heretofore, the motorman has had a comparatively easy time of it alongside the conductor. He has watched the street crossings, listened to the bell calls overhead, kept an eye ahead for trouble and children on the tracks, kicked the button on the floor, manipulated brake handle and electric bar as occasion demanded, taken his meals while on the jump, occasionally saw his family during the course of a day, and stood through every rain storm that came along, together with some other things, but there has never been a measure line on how he turned on or off power such as the conductor has in the line that keeps tab on the nickels.

"Now matters are to be different. The wattmeter will soon measure every ohm and volt and spark of current he applies to the wheels and wires of his car, and if he misses any—if the car goes too fast or the handle gets over the notch on the board too rapidly—the innocent-looking arrangement beneath his feet will tell it all, and he will be well employed. Both hands and feet will be constantly going—the right hand on the brakes, the left on the motor bar; the right foot on the warning gong and the left foot on the meter—and there will be no lost motion, for every movement will tell. This will enable him to sleep well at night.

"The wattmeter was introduced last week on Block 628 of the Tenth and Eleventh Streets line. It is an innocent-looking affair—just a square piece of black rubber that looks like an abbreviated doormat that can't be moved, and covers one spot all the time and at all times. It connects with the electric machinery of the boxes under the car, and tells tales of every movement of the current on a circular disc just like a gas meter tells the flow of gas. It has been in use in Pittsburgh over a year, and the inventor lives in that city. It is now in use in St. Louis and Chicago, and meets the object of saving the electric current handsomely. The motorman can't regulate it nor interfere with its workings in any way. He must keep his foot on it, however, all the hours the car runs, and it does the rest.

"The object of the wattmeter is to save power. The meter tells just how much current is necessary for every trip, and in Pittsburgh the motormen have just so many ohms at their disposal every day. If they get beyond they must explain. One day more than usual or the next day less than usual does not take from or add to any given surplus.

"The Traction Company now has special storage batteries in Germantown, on North Ninth Street, above Montgomery Avenue; at Fifth and South Streets, and at the foot of Beach Street, for the accumulation of power. During the hours of the day when travel is lightest power is held in check and stored away, to be sent out when travel is heavy and the cars need it. Heretofore this power has been wasted, but the wattmeter holds it in check the same as

gas and water are held back. The offices at Eighth and Dauphin Streets have a complete record of what is done, and when the wattmeter is generally in place on the car fronts inspectors will register every trip.

"A Union Traction Company employee said to-day: 'There is no knowing what this new arrangement will do, but it is coming. Everybody is interested, and nobody can explain it. That's the funny business about it.'

" 'What do you stand on it for?'

" 'I stand there to keep the current from passing through the bolts. That's all I know.' "

When this clipping was shown to Mr. Twining, chief electrical engineer of the Union Traction Company, he said, on recovering speech, that the wattmeter was of the usual G. E. pattern, and that it was put on to test the efficiency of some roller bearings the company is trying on one of its cars.

London Letter

[*From Our Regular Correspondent.*]

The new underground railway which the Central London Railway has opened to traffic this week has proved to be a great success, and all London seems to be as pleased with its latest novelty as a child would be with a toy. During the first day there were no fewer than 84,500 passengers who traveled by the new line, and thousands more stood about the stations and looked on. The universal verdict has been in favor of the new road, which has already been nicknamed the "Two-Penny Tube." The simplicity of the arrangements is also greatly appreciated, though the system of purchasing tickets and dropping them in "chopper" boxes at the gate, in the same manner as is done on the elevated roads in New York, is an absolute novelty to the public in this city. It is a system, however, which will commend itself to the public later on, and is already favorably commented upon. The luxuriance of the cars has also called for many remarks and one can hear on all sides favorable criticisms as to the lighting, the ventilation, the elegance, the comfort and the general pleasantness of the motion of traveling in this underground tunnel. For those who have to travel long distances the price of 2d. commends itself most favorably as the omnibus fare for the same distance amounts to 5d. The first day passed off with the greatest success, and everything worked as smoothly as if the road had been running for years. The majority of the public, however, did not know that for the past three weeks the directors have been running experimental trains at schedule time with the whole force of employees attending to the work just as if the road were open for traffic. In this way, therefore, when the road was thrown open everything started off with the greatest smoothness and each employee knew exactly what was expected of him. After a period of extreme heat in London, when the thermometer has been averaging 90 deg., for the past week or two the deliciously cool atmosphere of the tunnel has proved most grateful, the temperature being always in the vicinity of 55 deg. It may not be out of place to recall at this time that it is just ten years since the scheme was first promulgated, the first application having been made to Parliament in 1890. Since that time many of the most able and experienced engineers and business men who are familiar with railway business have been devoting continuous thought to the successful accomplishment of this railway. The company was actually floated in June, 1895, and the first operation was the sinking of the shaft at Chancery Lane in August, 1896. The cost of the double tunnel has been about £585,000 per mile, so that for the whole road the cost has been about £3,500,000. The line, as is well known, starts at the Bank, and goes to Shepherd's Bush, and is underneath great public thoroughfares throughout the entire length being directly underneath Cheapside, Newgate Street, Holborn, Oxford Street, Bayswater Road and Uxbridge Road. The journey by omnibus used to take one and a quarter hours, and as the running time on the underground road is only twenty-five minutes, it will be seen what advantages it possesses, especially when you can travel the whole distance for less than one half the 'bus fare. It looks as if the Central London Railway were destined to have a great success, and judging from the number of passengers who traveled during the first day, which, at the same rate, would be a yearly passenger return of 30,000,000, it looks as if it were quite possible that the estimated passenger traffic expected by the company of 50,000,000 would be soon realized.

The half-yearly general meeting of the Metropolitan Railway Company was recently held under the presidency of Mr. John Bell. After making a statement that the result of the half-year's working was that they carried to net revenue a balance of £202,004, out of which it was proposed to declare a dividend of 3¾ per cent per annum, Mr. Bell referred to the following clause in the report which had just been submitted:

"The arrangements, referred to in previous reports, for an experimental working by electricity between Earl's Court and High Street, Kensington, stations have been completed, and an electrical train has been working daily since May 31 last. In view of the importance to the Metropolitan and District Railway Companies of adopting electricity as a motive power, a committee consisting of three members from each of the boards of the companies has been appointed to consider the question of applying electric traction to the working of the Inner Circle, and it has been agreed between the companies to invite eminent electrical traction firms to submit plans and specifications, with detailed estimates and tenders for the necessary installation."

It thus seems very certain that before long part of the underground system at present operated by steam by the Metropolitan Company will be converted to electrical working. The directors have satisfied themselves by the experimental train which they have had working near Earl's Court for the past few months that it is quite possible to convert their system to electricity. The problem which they have is naturally one of considerable difficulty.

The Glasgow District Tramways Bill, which was promoted by William Murphy, of Dublin, which was passed by the Lord's committee last May, has just been thrown out by the select committee of the House of Commons, presided over by Sir Lewis M'Iver. The committee found that the preamble of the bill was not proved, but desired to put on record that in its view the original scheme was a good one, and calculated to be of much use to the district, but that the scheme had been so mutilated and loaded with conditions by the conflicting interests and the excessive demands of several local authorities that, at present, it appeared to the committee to be wholly unworkable. There seems no doubt that when the plan was first brought forward by Mr. Murphy for a system of tramways in Paisley and Renfrew that it was calculated to have been a great benefit in the vicinity of these two towns. Mr. Murphy, however, had to encounter the tremendous opposition of the Glasgow Municipality, and also had to encounter opposition from Paisley and Renfrew and other towns, each one of which insisted upon certain conditions being fulfilled, which, as the chairman of the committee stated, practically amounted to blackmail. The original scheme had therefore to become cut down to such an extent that there remained practically very little of it, and even Mr. Murphy himself now does not value it very highly.

The select committee of the House of Lords, of which the Earl of Camperdown is chairman, has had under consideration the bill promoted by the London County Council under which power is sought to enable the Council to use electricity as the motive power for trams which it already owns in the metropolis and other trams which, under the Tramways act, it may acquire. It was stated that the County Council already owned over 70 miles out of the 115 miles of line which exist in London, and by 1911, if the present policy of purchase is pursued, it will have acquired the remainder. The bill was opposed by the South Metropolitan Gas Company and the Lambeth Water Company, who feared that the proposal would cause electrolysis of their mains, and by the Lambeth and Wandsworth local authorities, who urged that they were not given adequate protection under the bill. Eventually the committee passed the preamble, subject to certain provisions being inserted for the protection of the gas and water companies. The Light Railway Commissioners, however, has refused to grant the order for the proposed electric tramways in Surbiton and Kingston, two suburbs of London, owing to the opposition of the local authorities and the Surray County Council.

An important report dealing with a proposal to construct a tramway extending along the Embankment from Blackfriars to Putney Bridge is being considered by the Chelsea Vestry. A certain scheme by which trams will be run by way of the Victoria Embankment, Victoria Street, Buckingham Palace Road, and the Chelsea Embankment to Putney has been approved by the improvements committee of the London County Council, subject to the local authorities in control of the various municipal areas through which the line will pass agreeing to contribute between them a third of the cost. Chelsea, it appears from the report, would have to pay as their share about £63,733, and the proposal is not regarded in a favorable light. The Vestry will be asked to point out to the London County Council that the money which would have to be expended on the trams would be spent to much better purpose if laid out for street improvements.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

STREET RAILWAY PATENTS ISSUED AUG. 7, 1900

655,216. Switch for Suspended Electric Conductors; J. Floyd, Washington, D. C. App. filed Dec. 8, 1899. The main and branch

wires each have an upwardly turned open loop, affording a passage for the flange of the trolley wheel.

655,217. Crossing for Suspended Electric Conductors; J. Floyd, Washington, D. C. App. filed Dec. 8, 1899. A modification of the preceding.

655,305. Track-Sanding Device; G. W. Mudd, Moberly, Mo. App. filed March 22, 1900. The motorman is able to open a valve to admit a blast of air for driving sand out of the sand-box onto the track.

655,349. Railway Track Structure; H. B. Nichols, Philadelphia, Pa. App. filed May 1, 1900. The hardened plate or block forming a continuation of the crossing rail is supported and secured by a soft metal filling which serves as a cushion, and also as the sole means for locking the plate in position.

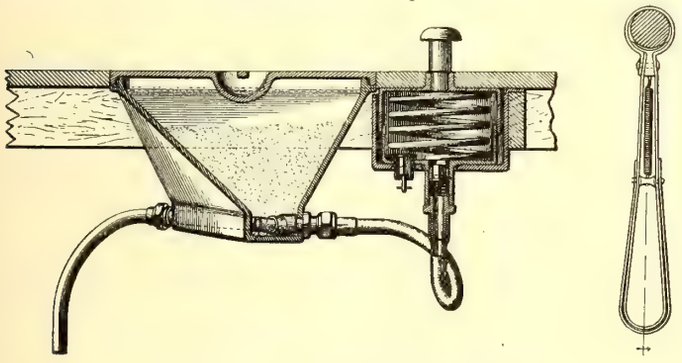
655,370. Rail-Joint; A. Relay, South Norwalk, Conn. App. filed Oct. 16, 1899. A projection from the end of one rail enters an opening in the end of the other, the two parts being shaped to interlock with each other.

655,386. Car Truck Frame; E. S. Woods, Chicago, Ill. App. filed Feb. 15, 1900. The frame comprises two parallel side frames, a transverse truck bolster detachably interlocking with each of the side-frames and removable springs between the bolster and side-frames designed to hold the bolster interlocked with the frames.

655,389. Safety Device for Electric Vehicles; F. E. Case, Schenectady, N. Y. App. filed May 20, 1899. In case the motorman becomes incapacitated, a device is attached to the controller, which cuts off the power.

655,400. Tie-Plate; W. Goldie, Wilkinsberg, Pa. App. filed Dec. 9, 1899. A metal plate upon which the rail rests, is provided with spurs to enter the tie and flanges to retain the rail.

655,428. Hand-Strap for Street Cars; T. E. Wardwell, Stamford, Conn. App. filed Feb. 3, 1900. The strap has two loops so that two persons may use it at once; one loop is retracted to an elevated position by a spring, so that it may be drawn downward for the accommodation of short persons.



PATENTS NOS. 655,306 AND 655,428

655,444. Tongue-Rail Fastening for Railways; P. Knittel, Crefeld, Germany. App. filed June 15, 1900. A fastening for a tramway tongue-rail consisting of a cross-key engaged in a slot of the tongue-rail pivot, and having its ends held in a slot of the base-casting.

655,449. Railway Switch; A. G. Moeckel, Detroit, Mich. App. filed April 22, 1899. The movable tongue is located in the hollow of a plate, and carries flanges which always cover the hollow to keep out snow and ice.

655,455. Electric Railway; W. B. Purvis, Philadelphia, Pa. App. filed April 24, 1900. The circuit is closed by a magnet carried by the car which lifts a flexible cable into contact with the terminals of the branch leading to the sectional conductor.

655,465. Car Truck; G. L. Stuedner, New York, N. Y. App. filed March 17, 1900. The wheels of the truck are flangeless, the function of the flanges being supplied by small wheels or discs independently mounted upon the truck.

655,566. Street Railway Car; G. Moore, Boston, Mass. App. filed Feb. 21, 1900. Details of construction pertaining to a flexible panel to be used in the construction of convertible cars.

655,634. Bearing for Car Trucks; C. H. Hartman, Allegany, Pa. App. filed June 4, 1900. The two bearing surfaces between the body and truck are provided with inclined faces between which balls are placed, the body being lifted when the truck turns, to reduce the friction at the bearing.

PERSONAL MENTION

MR. F. L. HART has resigned as general superintendent of the Washington Traction & Electric Company, of Washington, D. C.

MR. EUGENE E. HAWKINS has resigned as general superintendent of the New Paltz & Poughkeepsie Traction Company, of New Paltz, N. Y.

MR. D. F. BURRITT has resigned as general manager of the Palmer & Monson Street Railway Company and of the Central Massachusetts Electric Company.

MR. WILLIAM D. WEAVER, editor of the *Electrical World and Engineer*, of New York, was married last month in Bremen, Germany, to Miss Mildred E. Niebuhr. Mr. and Mrs. Weaver expect to sail for New York about Oct. 1.

MR. SAMUEL G. DE COURCEY has been elected president of the American Railways Company, of Philadelphia, to succeed A. A. McLeod, who recently resigned. Mr. De Courcey was born in Maryland and came to Philadelphia in 1863. He has been president of the Western New York & Pennsylvania Railroad since 1892.

NEWS NOTES

[*News notes for this department are solicited.*]

LOS ANGELES, CAL.—The Los Angeles Traction Company has made application to the City Council for three franchises for the extension of its lines.

DENVER, COL.—The Denver City Tramway Company has adopted a new bicycle carrier.

DENVER, COL.—The employees of the Denver City Tramway Company held a picnic on Aug. 8, the proceeds of which are to be devoted to the three athletic and literary clubs composed of employees of the company.

HARTFORD, CONN.—The Hartford Street Railway Company has equipped several of its open cars with eave troughs as a protection to passengers from the water which falls from the roof of the car during a rainstorm. The troughs run along the side of the car and are connected at the ends with a waste pipe which carries the water to the street.

HARTFORD, CONN.—The Hartford, Manchester & Rockville Tramway Company has announced through its president, M. S. Chapman, that hereafter every employee of the company who remains in its service five years shall be entitled to wear a service stripe, and also be entitled to an increase of 25 cents per day in wages. Five men, who have been in the employ of the company the required length of time, have been decorated with the stripe and receive increased pay.

WILMINGTON, DEL.—At the recent annual meeting of the stockholders of the Wilmington City Railway Company the following directors were elected for the ensuing year: John A. Rigg, Henry C. Moore, R. N. Carson, W. S. Bell, Thomas S. Bellah, Peter J. Ford and K. A. Fichthorn. No change was made in the management of the system. Numerous improvements have been made during the past year. Changes have been made in the tracks where necessary, new rails and switches being laid in some places. In fact, the entire Wilmington and Chester system has undergone improvement. A full equipment of summer cars had been provided for the Darby line and additional winter cars are now under construction.

JACKSONVILLE, FLA.—The Jacksonville Street Railroad Company has been successful in securing a franchise here.

CHICAGO, ILL.—The Chicago City Railway Company has ordered a number of convertible cars, and proposes to give them a thorough test this winter.

EAST ST. LOUIS, ILL.—The Granite City, Venice & East St. Louis Electric Railway Company has been granted an extension of six months, in which to complete the construction of its line. Work was stopped for some time by an injunction.

DIXON, ILL.—The City Council has passed an ordinance granting the Illinois & Rock River Electric Railway Company a franchise for the construction of an electric railway on River Street from the westerly line of Peoria Avenue to the city limits, or through the city. The franchise requires that construction work begin within one year, and that the line be completed and in operation within two years from the passage of the ordinance.

CHICAGO, ILL.—The Law Department of the city has been asked to decide the matter of the size of a bill a passenger may offer the conductor for his carfare. The matter has been investigated by counsel, who learned that Chicago has no ordinances on the subject. It is alleged that a conductor in charge of an Indiana Avenue car has in his possession a $10 bill belonging to a passenger, and which was given him three weeks ago for two fares, and that after repeated requests he has not secured the return of the change. It is to be made a test case.

NEW ALBANY, IND.—The New Albany Street Railroad Company has been granted a thirty-year franchise by the Council. There were two other bidders for the franchise.

WICHITA, KAN.—The Wichita Electric Railway & Light Company has decided to place its entire system in the hands of the Kings Daughters on Aug. 26. The young women members of the organization will act as conductors, and will generally have charge of the entire system. The entire revenue for that date will be donated by the company to the Children's Home fund.

ALBERT LEA, MINN.—The application of the Albert Lea & Geneva Lake Electric Railway Company for a franchise has been granted by the City Council. The franchise is granted for fifty years and requires that the company have 2 miles of road built and in operation within two years. A fare of 5 cents is to be charged for one continuous ride within the city.

BIDDEFORD, ME.—The Saco River Electric Railway has applied for a revival of its charter, which had lapsed under the statute.

ATLANTIC CITY, N. J.—The stockholders of the Atlantic City Passenger Railway Company have elected officers as follows: William H. Bartlett, president; G. A. Aldrich, vice-president; A. M. Jordan, treasurer; Eli M. Chandler, secretary; G. A. Aldrich, general manager; directors, G. T. Lippincott, E. J. Petroff, R. J. Powell, of Atlantic City; Thomas F. Durham and Frank Reeder, of Philadelphia. The company has rights to build a line across the Meadow turnpike and through Pleasantville and Absecon.

SCHENECTADY, N. Y.—The mayor has signed the ordinance granting the Schenectady Street Railway Company permission to extend its lines through Lafayette Street and Park Place to Nott Street.

SYRACUSE, N. Y.—Two cars of the Syracuse, Lakeside & Baldwinsville Railway Company collided head-on just outside of the city limits Aug. 8. Nine passengers were injured.

BUFFALO, N. Y.—President Ely, of the International Traction Company, has notified the Mayor that his request for the lowering of the steps of the one hundred new open cars placed in operation by the company this season will be complied with. President Ely asks that the citizens bear with the inconvenience until the advent of the winter cars, as it is impossible to make the necessary changes until new trucks have been placed under the cars. It will require several months to manufacture the new trucks.

BROOKLYN, N. Y.—A man who recently tried to stop a car here by placing a large cobblestone on the track of the Third Avenue line of the B. R. T. was fined $10. There was a delay on the road, and several cars darted past him regardless of his cries and shouts to stop. In mad desperation he placed the stone on the track, feeling sure that the motorman of the next car would have to stop and remove the stone before proceeding, and knowing that while this was being done he would have an opportunity to board the car. The man's name was obtained by the company, and he was promptly arrested.

BUFFALO, N. Y.—Arrangements are now completed for the opening of the Olcott extension of the Buffalo Railway Company on Aug. 29. The dedication of the new resort fitted up by the company at a cost of $75,000, will take place on the date of the great Niagara County farmers' picnic. The Olcott branch from Lockport passes through one of the greatest fruit-growing sections of the State. Officials of the road believe that Olcott will become one of the most popular resorts on Lake Ontario. The bathing beach is one of the finest to be found anywhere. A fine park has been fitted up, a large casino built and every provision made for the accommodation and pleasure of the thousands who will be attracted there by the delightful ride and the beauties of the place. A regular round trip fare from Buffalo of $1 has been decided upon, with special rates of 75 cents on Saturday and Sunday.

LANCASTER, OHIO.—The Lancaster Traction Company has laid off its conductors. Citizens threaten to test the State law passed last year requiring two men on each car.

STEUBENVILLE, OHIO.—The Steubenville, Mingoe & Ohio Valley Traction Company has decided to enter the lighting field, and is soliciting contracts for lighting and furnishing power. A franchise will be asked for if enough business can be secured.

TOLEDO, OHIO.—Ten people were injured in a street car accident here a few nights ago.

TOLEDO, OHIO.—The employees of the power house of the Toledo Traction Company, under the leadership of Superintendent O. E. Olson, gave a trolley party in the company's special car last week. N. E. Wood, of the General Electric Company, Schenectady, was the guest of the evening.

OKLAHOMA CITY, O. T.—The City Council and the Oklahoma City Land & Electric Railway Company, who have been at loggerheads for some time over a franchise grant, have reached an understanding, and a franchise has been granted by the Council which is acceptable to the company. One of the provisions of the ordinance is that the company has cars running on three lines within six months. The officers of the company are: J. M. Lindsay, of Gainesville, Texas, president; S. H. Baird, vice-president; G. R. Stone, secretary; J. H. Everest, general attorney, and George C. Kelly, of Oklahoma City, general manager.

PHILADELPHIA, PA.—The Union Traction Company received this week the first of a lot of new type convertible cars ordered from the J. G. Brill Company. The cars have a number of new features connected with the convertible arrangements. They have cross seats and end entrances, however.

PITTSBURGH, PA.—The Union Planing Mill Company and others have filed suit against the Pittsburgh, Knoxville & St. Clair Street Railway Company and Henry Stamm, trustee, in which they ask for a rule on William J. Fawcett, receiver of the company and on the Pittsburgh & Birmingham Traction Company, to show why the property, franchises, stock and real estate of the Pittsburgh, Knoxville & St. Clair Street Railway Company should not be again offered at public sale. It is alleged that the Pittsburgh & Birmingham Traction Company failed to make good the terms of the previous sale, the paying of the receiver's certificates of petitioners being a part of the consideration of the purchase by the Pittsburgh & Birmingham Traction Company at the previous sale.

ASHLAND, PA.—The Borough Council has finally accepted an amendment to the ordinance granted the Ashland & Centralia Electric Railway Company in July, 1899, by which the company is permitted to use North Third Street on which to place a siding for the storage of cars, and to be used as a passing siding. Under the conditions upon which the permit is granted the text of the original ordinance, which requires the company to operate their cars to First and Centre Streets, is not changed. The cars will run to the crossing at First and Centre Streets, and after discharging or accepting passengers will then run back to Third Street, and if it is necessary, will run into the siding at Third Street and thus avoid the cars of the Schuylkill Traction Company which may be on the Centre Street line.

PHILADELPHIA, PA.—The oldest conductor in Philadelphia, in point of service, is dead. He was James S. Reeve, and entered the service of the Arch Street Railway Company in 1863. He has been successively engaged in the service up to a few days before his death.

PROVIDENCE, R. I.—The petition of the Rhode Island Suburban Railroad Company for a franchise in Bristol was granted August 6.

MILWAUKEE, WIS.—The Council committee on street lights has recommended that the Council grant the Milwaukee Electric Railway & Light Company a five years contract.

TACOMA, WASH.—Four of the officers and employees of the Tacoma Railway & Power Company have been arrested, charged with manslaughter in connection with the Fourth of July disaster, in which thirty-nine persons were killed and over sixty injured. The four arrested are: S. Z. Mitchell, general manager of the company; F. L. Dame, general superintendent; Charles Purdy, assistant superintendent; F. L. Boehm, motorman of the wrecked car. Bail has been fixed in each instance, and the date set for hearing the cases.

KINGSTON, ONT.—The annual convention of the Canadian Electrical Association will be held here Aug. 29, 30 and 31. The programme has not yet been completed, but will include the following papers: 1. "Utilizing the Available Central Station Capacity." Prof. R. B. Owens, McGill University, Montreal. 2. "Use of Dynamo and Storage Battery in Telegraph Offices." W. J. Camp, C. P. R. telegraph office, Montreal. 3. "Power Factor as Affecting Operation and Investment, with Special Reference to Induction Motors and Enclosed Arc Lamps." F. H. Leonard, Jr., Montreal. 4. "Government Electrical Standards," O. Higman, Ottawa. 5. "Railway Subject: Giving Several Curves Showing the Average Power During a Day, and Maximum and Minimum Requirements for Power called for on the Quebec System." Mr. Blair, Quebec Railway & Lighting Company, Quebec. 6. "Rotary Converters." A. Gordon Grier and J. C. Hyde, Montreal. 7. "Conditions Affecting the Wave Form of Alternators." Prof. L. A. Herdt, McGill University, Montreal, Que. The City Council has made an appropriation for entertainment purposes, and granted the use of the City Council chamber for the sessions, also space in the City Hall for exhibits of electrical appliances, while the local electrical companies have agreed to furnish, free of charge, current and labor to exhibitors.

CONSTRUCTION NOTES

[Information regarding the building of new roads, enlargements of power plants, extensions, etc., will be much appreciated.]

BIRMINGHAM, ALA.—The Birmingham Railway & Electric Company is making a number of important additions and improvements to its system. A new line, 2 miles long, is being constructed to Owenton. Three blocks of new track are being constructed to connect the old steam line of the Highland Avenue and belt. This will give a new route to the residence portion of the city. The Avondale line was recently double-tracked from Avenue F and Twenty-Third Street to Twenty-Eighth Street and F. Now the grading is being done on the same line for a double track from Twenty-Third to Twentieth Street. The South Highland line has been torn up for some ten blocks, and the tracks are being relaid. A handsome new brick and iron round house and barn is about complete. This is 140 ft. x 100 ft. and is one of the most substantial buildings in the city.

MERIDEN, CONN.—The Meriden Electric Railroad Company contemplates making improvements at Hanover Park next season, which will cost $25,000. This season has proven a very successful one at the park, and the improvements to be made include the general overhauling of the entire grounds and the addition of many new attractions and novelties.

PENSACOLA, FLA.—President Northup, of the Pensacola Terminal & Railway Company has just returned from Baltimore, where he has been in consultation with the directors of the road in regard to the improvement of the system. It has been decided to rebuild and generally overhaul the entire system, and included in the improvements to be made are the overhauling of the lighting plant and system, the addition of new cars, the electrification of the dummy line and the general reconstruction of Palmetto Beach, which it is proposed to turn into a veritable Coney Island.

EAST ST. LOUIS, ILL.—The Venice, Granite City & East St. Louis Electric Railway Company has decided to extend its line. The line will run direct from Granite City to East St. Louis.

MITCHELL, IND.—An electric railway line is projected to connect Oolitie City, Bedford, Mitchell, Orleans, Paloi, West Baden and French Lick Springs.

PERU, IND.—The promoters of the Peru-Converse Electric Railway report that they have secured the right of way for the entire 22 miles except through Miami County, and a petition has been filed with the County Commissioners for a franchise to complete the route.

INDIANAPOLIS, IND.—The Indianapolis Street Railway Company has opened its line to Riverside Park.

INDIANAPOLIS, IND.—The Indianapolis Street Railway Company has selected a site for its new power house. When the new structure is completed, the company will abandon its present power house.

INDIANAPOLIS, IND.—The Indiana & Ohio Railroad is ready to build about 50 miles of electric railway, and will be glad to make the best contracts they can for the material to be used in the construction of the line. J. M. Gore is president of the company.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week in order to secure insertion in the current issue.

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Test of the Albany & Hudson Third-Rail Lines

The first trip over the third-rail line of the Albany & Hudson Railway, of Hudson, N. Y., was made Aug. 20. Power for operating the road was received from the company's new waterpower plant at Stuyvesant Falls, and the test was satisfactory in every respect. It is said that a speed of 60 miles an hour was attained at times.

Cleveland Companies May Carry Freight

The law department of the city of Cleveland has handed down an opinion citing that the Cleveland City and Cleveland Electric Railway Companies have the right to handle cars of the suburban companies carrying freight. The law department further says that the city cannot prevent the handling of freight, nor regulate the matter, so long as the traffic is conducted within reasonable bounds. The law department looked into the question at the instigation of the Council.

Mr. Abel of Chicago Inspects the Brooklyn Rapid Transit System

Howard Abel, president of the Lake Street Elevated Railroad, of Chicago, has been in Brooklyn for a few days inspecting the Brooklyn Rapid Transit system. Mr. Abel's trip is similar to one made by President Rossiter, of the Brooklyn Rapid Transit Company, to Chicago a few months ago, and was made for the same purpose, viz.: To study the transportation difficulties of the city and the methods by which they are overcome, and possibly to add a suggestion or two.

More Religious Advertising in Street Cars

The patrons of the Westport electric line in Kansas City, Mo., were greeted on the morning of the 15th with a new advertising card, among the others displayed on the car, which read: "How many minutes a day do you give your God?" Their curiosity was at once aroused, and this card was the talk of the city for a number of days. All efforts to ascertain who had the card placed in the cars were unavailing, but it is intimated that it was placed there by a prominent merchant, who is very religious, and who insists that his name be kept unknown. Several months ago the advertisement of a Wilmington, Del., church was placed in the cars in that city, but so far as we know these are the only instances in which such cards have been displayed in street cars.

Canada's Electric Railways

Up to the close of 1899 there were 632 miles of electric railway in Canada, as compiled by the government statistician, with a total car mileage of 29,646,847. The total number of passengers carried was 104,033,659, or a ride per capita of 20 miles. The mileage and passengers carried show that for each mile run the electrics carried three and one-half passengers; compared with the previous year the number of passengers carried increased nearly 9,500,000, and the number of miles run over 1,000,000. The number of transfers given in Toronto, alone, was 10,500,000. The amount of paid-up capital invested in electric railways is $21,700,000. The steam railroads in 1899 carried 16,168,191 passengers, with a train mileage of 25,292,859, thus making an average of one and one-half passengers per mile. The electric car mileage is, therefore, 4,500,000 in excess of the passenger and mixed trains of the steam railroads. Together the Canadian steam and electric railways carried over 120,000,000 passengers, the proportion being thirteen by steam to eighty-seven by electricity.

Duluth and Superior Systems Consolidated

The consolidation of the Duluth Street Railway Company, of Duluth, Minn., and the Superior Rapid Transit Railway Company, of West Superior, Wis., has been completed. The new company will be known as the Duluth-Superior Traction Company, and is incorporated under the laws of Connecticut, with a capital stock of $5,000,000, divided into $1,500,000 preferred stock and $3,500,000 common stock. The new company controls all the street railway lines in both cities with a total mileage of 73. The consolidation was effected by the transfer of the property of the Superior Rapid Transit Railway Company to the Duluth Street Railway Company, which company has authorized an issue of $2,500,000 first mortgage and collateral trust 5 per cent thirty-year bonds, of which amount $500,000 are to be kept in the treasury for future improvements, etc. The holders of old first mortgage bonds of both companies were offered the opportunity of even exchange for the new bonds, and the large part of them have accepted the offer. The con-

solidated bonds upon the Duluth property were all deposited with Brown Bros. & Company, under an agreement to receive in exchange therefor 110 per cent in new preferred stock and ninety per cent in new common stock. The Central Trust Company is trustee under the mortgage securing the new bonds and also registrar of the stock. The Farmers Loan & Trust Company, of New York, is transfer agent for the stock. C. G. Goodrich, vice-president of the Twin City Rapid Transit Company, of Minneapolis, is president of the new company, and L. Mendenhall, president of the Duluth Street Railway Company, is secretary and treasurer of the new company.

Convention of the Canadian Electrical Association

The tenth convention of the Canadian Electrical Association will be held in Kingston, Ont., Aug. 29, 30 and 31. Every effort has been made by those in charge for the comfort of the delegates, and the city has been thrown open to them. The city officials have been very hospitable, and have made an appropriation for entertainment purposes and granted the use of the City Council chamber for the sessions; also space in the City Hall for the exhibit of electrical appliances. The convention will be opened on the 29th at 10 a. m., with a welcome speech by the Mayor, after which the president of the association will address the delegates. The usual routine business, such as the report of secretary-treasurer, reading of minutes, presentation and discussion of papers, will follow. Aug. 30 will be devoted to the consideration of the president's address, reading and discussion of papers, etc. Aug. 31 will be devoted to selecting a place for the next meeting, determining the date of such meeting, election of officers etc. Among the papers to be presented at the meeting are: "Utilizing the Available Central Station Capacity," by Prof. R. B. Owens, McGill University, Montreal; "Rotary Converters," by A. Gordon Grier and J. C. Hyde, Montreal; "Railway Subject, Giving Several Curves, Showing Up the Average Power During a Day, and Maximum and Minimum Requirement for Power Called for on the Quebec System," by Mr. Blair, Quebec Railway & Lighting Company, Quebec. The social features of the convention include a searchlight excursion among the Thousand Islands, tendered by the Mayor and citizens of Kingston; a banquet at the Hotel Frontenac, and a grand spectacular band concert, introducing an electrical musical fantasy of the Battle of Paardeberg, with electrical effects and fireworks.

Chemical Specifications for Rails

In a paper read at the recent annual meeting of the American Society of Civil Engineers held in London, Robert W. Hunt referred to the chemical specifications for rails, and said in part:

"The writer has gone on record so often as believing that in the absence of work at low heats, incident to the present method of making heavy-sectioned rails, it is important to increase the carbon with the section to as great an extent as the phosphorus present will permit, without incurring risk from breakage, that it seems unnecessary to repeat the arguments."

At the Atlanta meeting of the American Institute of Mining Engineers, in October, 1895, the writer presented a set of specifications for "Steel Rails of Heavy Sections Manufactured West of the Alleghenies." In accordance with these specifications thousands of tons have been made and used with satisfactory results. During the last two years the Western makers have declined to limit the phosphorus to less than 0.10 per cent, but, in fact, have been making steel with a fraction less than that amount—say 0.09 to 0.096 per cent. And he regrets to say that in many cases they insist that the amount of carbon shall be less than that which he has advocated. He believes, however, that gradually, higher carbon will prevail, and certainly has not had any cause to change his mind on the subject. His experience as a steel rail maker, and as an observer of the wear of steel rails of many sections and diverse chemical composition, leads him to advocate: First, work, after careful heating of the steel, and continued until its temperature has been much reduced. Second, that the carbon percentages shall be increased in proportion to the increase of rail section, the ultimate amount being, of necessity, limited by the contained percentage of phosphorus. In all cases he advocates the use of drop tests, on samples from each heat of steel.

At present many of the American railway engineers use the drop test, but none of them demands the static or tensile tests insisted upon by so many engineers of other countries; nor does the writer think there is any necessity for these latter. The chemical analyses and drop tests are all sufficient.

As a matter of record, the writer gives the chemical formulas contained in his specifications of 1895, in accordance with which, as stated thousands of tons of rails have been made and have given good results. And while at present the Western makers decline to limit their steel to 0.085 per cent phosphorus, the writer certainly sees no reason to decrease the carbon. In other words, so many rails have been made and proven safe with quite as much carbon as given in these specifications, and with 0.10 per cent phosphorus, that the writer does not think the former element should be made less, certainly not until the details of manufacture have been changed.

Sec. 8.—The carbon in the 70-lb. section shall not be below 0.43 per cent nor over 0.51 per cent. In the 75-lb. section, not less than 0.45 per cent nor over 0.53 per cent. In the 80-lb. section, not less than 0.48 per cent, nor over 0.56 per cent. In the 90-lb. section, not less than 0:55 per cent, nor over 0.63 per cent. In the 100-lb. section, not less than 0.62 per cent, nor over 0.70 per cent.

The phosphorus shall not exceed 0.085 per cent.

The silicion shall not be below 0.10 per cent.

The remainder of the chemical composition of the steel to be left to the maker's judgment.

Color Ordinances

Reference has been made in recent issues of this paper to the ordinances existing in certain Southern cities as to separate accommodations for colored and white passengers. Below is given the text of an ordinance recently passed in Montgomery, which is a sample of those in other cities:

An Ordinance to Regulate the Transportation of Passengers on Street Railways of the City of Montgomery and Its Police Jurisdiction.

Section 1. Be it ordained by the City Council of Montgomery as follows: That all street railways operated in the city of Montgomery and its police jurisdiction shall provide separate accommodations for the white people and negroes on said street railways by requiring the conductor or other employee in charge of said car or cars to assign passengers to seats on the cars under their charge in such manner as to separate the white people from the negroes when there are both white people and negroes on the same car, except that negro nurses having in charge white children or sick or infirm white persons may be assigned seats among the white people.

Sec. 2. Be it further ordained: That all conductors and other employees while in charge of cars are hereby invested with the police power of a police officer of said city to carry out said provision, and any passenger refusing or failing to take a seat among those assigned to the race to which he belongs—if there is any such seat vacant—at request of conductor or employee in charge of said car, shall, upon conviction, be fined not more than $100.

Sec. 3. Be it further ordained: That all conductors and other employees superintendents of companies, and any officer, agent or employee who shall fail or refuse to provide for, and enforce such separation of the races as is herein provided upon the cars of said company operating in the city of Montgomery and its police jurisdiction, shall, upon conviction, be fined not more than $100 for each day they so fail to provide such separate accommodations.

Sec. 4. Be it further ordained: That nothing in this ordinance shall be construed as prohibiting the street railways from separating the races by means of separate cars or trailers on such lines as they may see fit.

Sec. 5. Be it further ordained: That this ordinance shall take effect immediately after its adoption.

Adopted Aug. 6, 1900. Approved Aug. 10, 1900.

E. B. Joseph, Mayor.

Street Cars in Glasgow

United States Consul Taylor at Glasgow makes the following report to the State Department regarding the street railway system of Glasgow:

"The street railway system of Glasgow is owned and operated by the city under the direct supervision of a committee of the City Council. The report for the year ended May 31, 1900, shows that the total length of double track operated by the city is 41 miles, 1 furlong, 178 yds. over 42 miles, 2 furlongs, 161 yds. of streets, making a total length of single track of 83 miles, 3 furlongs, 119 yds.

"The gross capital expenditures for the system since 1894 (independent of operating expenses) have been $5,164,975, and the present indebtedness is $4,061,806. The capital invested is $4,559,502. Of the 41 miles of double track, 5 miles have electric traction, the rest being operated by horses. The total receipts of the system during the year were $2,286,850. The working expenses were $1,676,412, leaving a balance of $610,438, of which there was expended some $84,000 for interest on capital, $57,501 for sinking fund, $156,096 for depreciation written off capital, etc. One item of $60,000 consists of payments made to the general revenue fund

of the city, which is in lieu of the amount which the city would receive in taxes, it is presumed, were the system operated by a private company. The balance goes into the reserve fund.

"There are 3400 persons employed, including 100 clerks. The general manager receives $6800; the chief engineer, $2400; the electrical engineer, $2000; and the mechanical engineer, who has charge of the power station, $1216. Switch boys receive 28 cents per day; trace boys, from 40 to 52 cents per day; car cleaners, from 88 cents to $1 per day; drivers, conductors and motormen, from $1 to $1.12 per day. These rates apply to Sundays and week days alike.

"The rolling stock consists of 384 horse cars, 132 electric cars (47 only of which are now running), 17 omnibuses, 39 lorries, and numerous carts, wagons and vans. There are 4411 horses.

"Work is now progressing, with the object of changing the entire system to electric traction, which it is hoped to have completed within the next eighteen months. No underground conduits will be used, according to the present plans. Fares range from 1 cent for first half mile to 2 cents for a mile; the longest ride is 6 miles, costing 6 cents. No transfers are issued, and tickets are not used.

"The committee of the City Council having supervision of the tramways receives no compensation. For that matter, however, no member of the city government of Glasgow, including lord provost, town councilors and bailies (police judges), receives compensation. The city of Glasgow has a population of about 850,000 and spreads over an area of nearly 12,000 acres.

"There are no electric or other tramways extending out of Glasgow to other towns or cities. Within the city is an underground cable road which makes a circuit of about 5 miles and is owned and operated by a private company. The rate of fares on this road is about the same as that prevailing on the surface roads."

Trolley, Steam and Third Rail in Connecticut

An article appearing under this caption in a recent issue of the *Railroad Gazette* enumerates the methods adopted by one steam railroad—the New York, New Haven & Hartford—to choke trolley competition. This company early realized that the introduction of the trolley meant reduced earnings, and at once set out to oppose all trolley projects. Its opposition began in the State Legislature, where every effort was made to squash the project. If, however, the road was finally built, the policy of the company was to buy it outright. We give the main part of the paper here, as it will undoubtedly interest those of our readers who have met with opposition in the projection of a system entering a steam railroad territory:

"In the sharp conflicts of the New York, New Haven & Hartford (Consolidated) Railroad Company with the promoters of parallel trolley enterprises, the efforts of the great steam corporation were largely centered against the interurban trolley projects. So successful had its resistance been that up to a few years ago, out of eighteen cities in the State only four were connected by trolley lines, and those from cities in two cases so contiguous that they formed, in effect, single municipalities. The change during the last four years, and particularly during the last two, is significant. Now, out of the eighteen cities in the State containing about 65 per cent of the whole population of Connecticut, twelve have trolley connection with other cities. Six cities—Waterbury, Meriden, Danbury, Middletown, Willimantic and Putnam—are still segregated, and one of them, Willimantic, has, as yet, no local trolley system. Of the six segregated cities, moreover, Middletown is pushing for trolley connection with Hartford; Meriden for connection with Middletown, Waterbury and New Haven, and a more important enterprise looks to the extension to Waterbury of the trolley system of the lower Naugatuck Valley. Within a year the tracks of the Bridgeport Traction Company have been extended to Shelton and, practically, to the cities of Ansonia and Derby, while the Norwich-New London trolley parallel, the cause of a long and picturesque contest reaching over several years, has just been opened for traffic. A few years more must undoubtedly find the interurban trolley system of the State complete, so far, at least, as to leave no segregated cities. It has already advanced so far and at such a pace as to create a new situation and give rise to some suggestive problems in future rivalries of steam and trolley.

"In meeting these interurban extensions the Consolidated Company has not been idle. Some of them, including one or two of the most serious, the steam company is still blocking in the State Legislature. The third rail has been used thus far only on the Highland division from Hartford to Bristol, a distance of about 17 miles. In one case, the connection between Bridgeport and New Haven, the Consolidated Company allowed the connecting trolley line to be built, relying on the crookedness and indirection of the route between the two cities. But its immediate policy is evidently the renewal of its old plan of 'breaking' parallels by out and out purchase of trolley roads—illustrated within a few months by its reported and presumptive purchase of the Greenwich system and of the People's Tramway, of Killingly—the latter purchase not publicly announced, but well assured, and of such a nature as to deserve its paragraphic description.

"The People's Tramway Company began as a distinctively parallel enterprise looking to both passenger and freight competition with the Norwich & Worcester division of the Consolidated, essentially a freight division with low grades. The trolley charter was a liberal one, giving rights to build 31 miles of track, reaching eleven places, with 23,000 inhabitants, and to build to the northern Connecticut State line, connecting with a Massachusetts trolley system reaching south from Worcester. As a whole, it threatened a complete parallelism from Norwich to Worcester with freight carrying as an important, if not primary, object. To avert the danger the Consolidated Company has bought out the whole enterprise; it is building a dam to supply a great waterpower to furnish motive power for the trolley, and light for the communities reached by its wires; it proposes, if necessary, to build to the State line to preserve its own territory; and freight service to the steam railroad stations on lateral trolley lines forms an important part of its plan, the seemingly paradoxical feature of which is a steam company's paralleling itself by trolley for the sake of controlling territory and preserving its own traffic. The results of this novel and homeopathic device, on a pretty large scale, of meeting trolley rivalry, will be most instructive, but will not, of course, be evident for some years to come. Meanwhile the Consolidated Company, at uncertain cost, certainly 'protects' its Norwich & Worcester division.

"The consolidation of Connecticut trolley systems has gone on swiftly and surely, and at an accelerating pace. At the opening of the year 1893 there were 147 miles of street railway in the State. There are now about 490 miles. They are represented nominally on the schedules of the State Railroad Commission by thirty-one companies, but these, by consolidation, have, in fact, been reduced to sixteen companies. Of the 490 miles of trolley track in the State about 130 miles are owned or controlled by the so-called 'Young Syndicate,' commonly regarded as identical with the United Gas Improvement Company, of Philadelphia; about 90 miles by the Fair Haven & Westville Company, and about 62 miles by the Hartford Street Railway Corporation, making 282 miles, or somewhat more than 57 per cent of the Connecticut mileage controlled by three interests. The Consolidated Company owns a trolley trackage of about 42 miles, which would give about 66 per cent of the trolleys of the State now controlled by four interests, and a far larger percentage were the values of the four trolley interests to be reckoned; and consolidation still goes rapidly on, carrying with it, in not a few cases, lighting plants and functions also.

"In the long rivalries of electricity with steam in the State this merger of electric interests betokens new conflicts and new conquests. The steam corporation must hereafter meet in the Legislature not scattered and divergent trolley forces, but centralized ones, backed, in some cases, by exotic capital, and powerful whether considered individually or apart. At least one of the large trolley combinations may be set down as very aggressive, planning extensions, some of them parallels, and almost necessarily relying in part on such extensions, together with possible freight and express business for returns on the large prices paid for acquired roads. Small economies in operation, blanket mortgages and stock bonuses hardly supply an intelligent motive in the trolley mergers. Ulterior aims which menace steam-railroad interests and imply new contests may reasonably be looked for."

Taxation in Ohio

The Ohio State Board of Commerce, of which E. M. Thresher, of Dayton, is president; C. B. Murray, of Cincinnati, is general vice-president; C. D. Firestone, of Columbus, is treasurer, and Henry A. Griffin, of Cleveland, is secretary, has issued the following circular:

August 1, 1900.

To the Citizens and Business Men of Ohio:

GENTLEMEN.—A widely disseminated discussion of clearly defined propositions is an indispensable preparation for the enactment by the State Legislature of measures to promote efficient government and safeguard the interests of taxpayers.

The people should derive benefits from government of greater value than its cost. When taxation is kept within such a limit and is so laid as to produce this result, it promotes prosperity. When

it exceeds this normal limit, or is not justly laid, it is oppressive.

No State has succeeded in devising a satisfactory system of taxation. Ohio can do so and become an example for others.

Legislation affecting municipal affairs absorbs fully 75 per cent of the time of the Legislature. Municipal debts and taxation are increasing at an alarming rate. The relations between municipalities, the people and public service corporations are not satisfactory. During every session of the Legislature attempts are made to enact measures on these subjects that are not properly drawn.

As a means of continuing its work upon these subjects and to secure a popular and wisely guided discussion of them, the Ohio State Board of Commerce has arranged to use the columns of *Public Policy* for an open discussion of the propositions following:

1. The objects of taxation for State, county or local purposes should be separated so that assessments shall affect only the tax district for which they are made.

2. Taxation for unnecessary purposes, and to provide funds to cover waste and extravagance, can be prevented by a needed administrative inspection and publicity.

3. Efficiency and economy in the administration of public business can be developed and maintained only by a uniform system of accounting, prescribed and audited by the State, and the publication of annual comparative statistics.

4. Deficiencies to be paid by taxpayers, in the case of publicly owned and operated industries, should be prohibited by providing that service rendered shall not be sold to private or other users at less than its true and entire cost.

5. Public mortgages on taxpayers' property for the purpose of acquiring and operating public service industries should be prohibited. Bonds authorized for such purposes should be secured only by mortgage on the use of all public rights of way used by, the property acquired for, and the revenue derived from, the industry, without recourse upon funds raised by taxation.

6. Corporations owning and operating public service industries should be regulated by contracts between them and the local or the State government, for an exclusive supply of the service they are to render for private and public use. Such contracts should provide that the price to be charged for the service should cover only cost plus a reasonable profit on actual investment, and stipulate that all accounts of the contracting corporation necessary to the determination of cost shall be kept in form prescribed by and audited by the State.

7. Efficiency in office is the true test for public employees. Merit shown by service record should be the means for retaining employment and winning promotion, to the exclusion of all other influences.

8. Self-government for every village and city should be secured by a general law providing for their uniform organization under municipal constitutions of their own adoption.

To make certain the enactment of laws in conformity with these propositions, by the next Legislature, one hundred or more persons in each legislative district should be in touch with the discussion of these subjects, for his own information, and to enable him to influence others. This will secure a uniform presentation of these subjects throughout the State. It will educate constituents and representatives to the same views, and will render the enactment of the legislation desired certain.

No fund is necessary for this purpose. The only requirement is that the citizens and business men of each district shall provide for their own district. When this is completely done the whole State will be cared for.

Unintelligent legislation costs much more than the educational work necessary to secure correct legislation. This is a perfectly sound proposition. We therefore believe every citizen and business man can better afford to pay $2 for a weekly, high-class journal, pledged to publish all this board may require, and one well equipped to guide the discussion intelligently, than not to have the work done.

For this purpose and upon this basis your co-operation is requested.

The Ohio State Board of Commerce,
(Signed) E. M. Thresher, President.
(Signed) Henry A. Griffin, Secretary.

Awards to American Exhibitors at Paris

On Aug. 17 the French officials announced the list of awards to American exhibitors at the Paris Exposition. Every line of industry and art received recognition, and, in all, the United States secured 1981 awards. Of these 220 were grand prizes, 486 gold medals, 583 silver medals, 422 bronze medals, 270 honorable mentions, and a long list of gold, silver and bronze medals for collaborators.

Below are given a list of the principal exhibitors, as given out to date, in the departments of machinery and transportation, who received grand prizes or gold medals:

DEPARTMENT OF MACHINERY—GROUP IV.

GRAND PRIZES

Worthington Pumping Engine Company.
Batcheller Pneumatic Tube Company.
Brown & Sharpe Manufacturing Company.
Pratt & Whitney Company.
E. W. Bliss Company.
Niles Tool Works Company.
J. A. Fay & Egan Company.

GOLD MEDALS

Ball Engine Company.
William Sellers Company.
George F. Blake Manufacturing Company.
Tinius, Olsen & Company.
Otis Elevator Company.
Rand Drill Company.
Charles A. Schieren & Company.
Crane Company.
Ingersoll-Sergeant Drill Company.
Shaw Electric Crane Company.
Simonds Manufacturing Company.
Chicago Pneumatic Tool Company.
Morse Twist Drill & Machine Company.
Cincinnati Milling Machine Company.
Hendy Machine Company.
Warner & Swasey.
Norton Emery Wheel Company.
Bement-Miles Company.
E. C. Atkins & Company.
Gisholt Machine Company.
Jones & Lamson Machine Company.
F. E. Reed Company.
Deering Harvester Company.
Bullard Tool Company.
Pond Machine Tool Company.

DEPARTMENT OF MACHINERY—GROUP V.

GRAND PRIZES

American Steel & Wire Company.
E. C. Acheson.
Rowland Telegraphic Company.
Western Electric Company.
John A. Roebling's Sons Company.

GOLD MEDALS

Bullock Electric Manufacturing Company.
Lorain Steel Company.
Western Electric Company.
Alvin Manufacturing Company.
National Carbon Company.
Tiffany Glass & Decorating Company.
C. J. Toerring Company.
Ward Leonard & Company.
Helios-Upton Company.
Holophane Glass Company.
Hart & Hegeman Manufacturing Company.
Edison Phonograph Company.
Western Electrical Instrument Company.
Mica Insulator Company.

DEPARTMENT OF CIVIL ENGINEERING AND TRANSPORTATION

Phœnix Bridge Company.
Boston Transit Commission.
Baldwin Locomotive Works.
Pressed Steel Car Company.
J. B. Brill Company.
Westinghouse Air Brake Company.
Standard Electric Company, of California.
American Steel & Wire Company.
The New York Air Brake Company.

Annual Report of the Brooklyn Rapid Transit

The annual report of the Brooklyn Rapid Transit Company for the year ending June 30, which has been awaited with so much expectation in financial circles, was made public Aug. 17. It was officially designated a "Preliminary comparative statement of the

Brooklyn Rapid Transit and constituent companies for years ending June 30, 1899, and June 30, 1900," and shows on a basis of the surplus of $526,772 reported for the year's operation, about 1.17 per cent applicable to dividends on the company's $45,000,000 of stock. The report in detail shows:

Receipts	1899	1900
Passengers	$10,793,984	$11,206,716
Freight, mail and express	36,791	61,305
Advertising	109,487	108,783
Rents	140,811	167,253
Other miscellaneous income	234,960	224,493
	$11,316,033	$11,768,550
Expenses		
Maintenance of way	$374,947	$415,729
Maintenance of equipment	983,216	882,183
Operation of power plant	948,749	964,665
Operation of cars	3,593,367	3,551,476
General expenses	582,175	494,530
Damages	738,837	797,790
Taxes	636,635	736,721
Net fixed charges	3,659,988	3,398,684
	$11,517,914	$11,241,778
Surplus or deficit	(D) $201,881	(S) $526,772
Surplus June 30, 1899		96,654
Total surplus, June 30, 1900		$623,426

The operations of the Kings County Elevated for June, July and August, 1900 and 1899, are not included in above, the company having been operated independently during that period.

The above figures include the full effect of the strike which occurred on July 16, 1899. The extent of injury thereby caused is partially shown by the figures for July, 1900, as compared with July, 1899, as follows:

July	1899	1900
Gross receipts	$976,801	$1,141,742
Expenses, including taxes	719,796	670,642
Net earnings	257,005	$471,100
Net fixed charges	294,351	293,642
Surplus or deficit	(D) $37,346	(S) $177,458

CONDENSED BALANCE SHEET FOR ALL COMPANIES

June 30, 1900

Assets		
Cost of road and equipment		$85,984,973.47
Additions and betterments not yet distributed		85,773.39
Equity Brooklyn city construction		5,018,105.10
Equity Prospect Park & Coney Island construction		108,426.96
Guarantee fund		4,005,755.00
Treasury bonds		5,513,000.00
Stock, B. R. T. Company		146,228.00
Accounts receivable		311,903.62
Prepaid insurance		34,260.51
Supplies		516,606.88
Cash on hand		1,470,287.54
		$103,195,320.47
Liabilities		
Capital stock, B. R. T. Company		$45,000,000.00
Capital stock constituent companies not owned by B. R. T. Company.		
Nassau pref. outstanding	$448,000.00	
B. U. E. pref. outstanding	285,646.58	
B. U. E. common outstanding	807,027.87	
		1,540,674.45
Funded debt—		
Sea Beach Railway Company	650,000.00	
Brooklyn, Queens County & Suburban Railroad	6,574,000.00	
Brooklyn Heights R. R. Company	250,000.00	
Brooklyn Rapid Transit Company	7,000,000.00	
Nassau Electric R. R. Company	15,000,040.00	
Brooklyn Union Elevated R. R. Co.	23,000,000.00	
		52,474,040.00
Loans		1,000,000.00
Interest accrued		116,578.62
Taxes accrued		596,052.04
Rental accrued		686,140.19
Audited vouchers		641,396.85
Accounts payable		110,106.30
Real estate mortgages		226,725.00
Contingent liabilities		180,181.27
Surplus		623,425.75
		$103,195,320.47

MEMORANDUM OF TREASURY ASSETS

Stock	Par Value
Brooklyn Rapid Transit Company	$146,228.00
Brooklyn Heights Railroad Company	200,000.00
Brooklyn, Queens County & Suburban R. R. Co.	2,000,000.00
Nassau Electric Railroad Company. Common	8,500,000.00
Nassau Electric Railroad Company, 4 per cent. Cumulative Guaranteed Preferred	6,052,000.00
Brooklyn Union Elevated Railroad Company. Common	12,192,972.13
Brooklyn Union Elevated Railroad Company. Preferred	4,714,353.42
Sea Beach Railway Company	650,000.00
Coney Island & Gravesend Railway Company	35,400.00
	$34,490,953.55

Bonds	Par Value
Brooklyn, Queens County & Suburban first mortgage bonds	$2,000,000.00
Brooklyn City Railroad Company, first mortgage bonds	1,627,000.00
Brooklyn Rapid Transit Company, gold 5s	375,000.00
Brooklyn Union Elevated first mortgage 4-5s	3,111,000.00
Kings County Elevated, mortgage 4s	2,000,000.00
Nassau Electric, first consolidated 4s	27,000.00
Grand total	$43,630,953.55

Auditor's office, Aug. 17, 1900.

Militantly British

The large orders for tramway apparatus awarded in England during the last few years to American manufacturers have had a disturbing effect upon the manufacturers of that country. Occasionally this feeling finds expression, as is shown by the following editorial appearing in one of the English engineering magazines under the title of "British Municipal Supporters of Foreign Competition":

"We are truly at a loss in what language to place before our readers an act so unpatriotic on the part of the local authorities of a British municipality, that we should refuse absolutely to believe it to have been committed had we not before us in black and white the fullest proof in the form of a document signed by the Borough Engineer of Southend-on-Sea. That the ratepayers of that town can be aware of the way in which their municipal officers are spending the rates is not creditable, and we feel convinced that the truth will be a shock to them as great as it must be to every patriotic Englishman. At this very moment, when the technical, as well as the political, press of our country unanimously endeavors to stir up our manufacturers to make a firm stand against foreign competition, and in this very hour of earnest effort to rally British producers, the Corporation of Southend-on-Sea throws into the lap of our American competitors the funds which have been entrusted to it by the community which it has the honor of representing.

"Southend-on-Sea is in want, it seems, of certain truck and car equipment for an electric trolley line, and only a few weeks ago visitors to the Agricultural Hall in London had an opportunity of seeing that such material is obtainable in our country, at reasonable prices, from industrial concerns that are exclusively British, and which spend the money they receive in our own country, employing British brain and muscle and encouraging British manufactures. What more natural, therefore, than to offer to such firms an opportunity of competing for the supply of the material required by the above-named Corporation? This is so obvious that the local authorities of Southend-on-Sea realized that, by the merest rules of decency, they were obliged to ask these firms for tenders. It is one of our best known engineering firms whom we have to thank for handing over to us the document that was sent to them. On page one of the specifications, where the Corporation describes what motors are wanted, we read as follows: 'The equipment under this section *must* consist of the following apparatus and materials, inclusive of supply, delivery and fixing. Each car to be supplied with: Two *Thomson-Houston* G. E. 52 railway motors on ten double-deck cars; two *Thomson-Houston*

G. E. 58 railway motors on two bogie cars; two *Thomson-Houston* G. E. 800 railway motors on two single-deck cars,' etc. Why any British firm, excepting the British Thomson-Houston Company, should be invited to furnish the above-named motors is an absolute mystery, for the choice of Thomson-Houston manufactures in preference to others has obviously been made beforehand, and naturally these manufactures cannot be supplied cheaper by anybody else than the Thomson-Houston Company. Since, however, there is a *British* Thomson-Houston Company in existence, our readers will perhaps say that the selection, although it indicates favoritism, is at least not necessarily unpatriotic. Granted, so far; but let them read what follows on page two: 'The motors shall be of the *General Electric of America's* manufacture.' Here, then, we see that not the *British* Thomson-Houston Company is intended, but it is stated in so many words that no British makers need apply, not even such as are called British by courtesy, and that the goods *must* be of *American* manufacture. Again on page three, for instance, we find, with reference to 'Controllers,' that these also 'are to be of the series parallel type of the *General Electric of U. S. A.*' On page five, with regard to 'Trucks,' occurs the following stipulation: 'The twelve four-wheeled trucks shall be of *Brill* (21-E. type, with solid forged frame) or *Peckham extension manufacture*,' *i. e.*, American, and 'the four bogie trucks are to be *Brill* or *Peckham maximum traction trucks*,' while 'the *axles* are to be of open-hearth steel of *Pennsylvania Railroad* standard, quality and test.' On the next page, finally, we read that 'four bogie *Brill* or *Peckham maximum* trucks are to be provided for,' and so on throughout the whole document. To make *American* manufacture, in a British municipal enterprise, a *conditio sine qua non*, and to deprive British manufacturers of even a chance of competing, is an act on the part of the local authorities of Southend-on-Sea that the patriotic ratepayers of that town—and we trust that these form a vast majority—should chastise as a gross abuse of their confidence; but to send to British firms a copy of a document of this nature, under the pretext of inviting tenders, is an action that, in the name of these firms, we feel it our duty to stigmatize as a disgrace for all those responsible for it. We most earnestly hope that never again shall we have occasion to bring to public notice a breach of loyalty to British interests so flagrant as that committed by the Corporation of Southend-on-Sea."

Experiments With Electric Traction on Trunk Railways*

BY N. H. HEFT
(Chief of electrical department, New York, New Haven and Hartford Railroad Company)

To procure such data as would enable the writer to submit a report of value to the Congress, on the above subject-matter, a list of questions was sent to all the managements of main line railways, members of the Congress. Seventeen of them replied that no experiments with electric traction had been made on their lines. The New York, New Haven & Hartford Railroad Company, Pennsylvania Railroad Company, and the Baltimore & Ohio Railroad Company replied that they had made experiments with electric traction on their main line railways, and the detailed answers of these companies may be found in the appendix.

Experiments with electric traction on main lines of steam railroads in the United States were begun in the early part of the year 1895. The managers of steam railroads were forced to take up these experiments on their systems, owing to the great inroads made in their passenger receipts, due to competition of the electric street railways, which, in some localities, amounted to 80 per cent. These street railways brought a new factor into the transportation problem, and one with which the steam railroad managers were wholly inexperienced.

With their tracks laid in the public streets of cities and extending to suburban and even interurban districts over public highways and private right of way, and, owing to their close proximity to homes and places of business, with frequent service and cheap fares, they had demonstrated that such a system of transportation was much more attractive to the traveling public than the one furnished by the steam railroads, and not only seriously affected the regular passenger business of the steam railroads, but created a pleasure traffic wholly their own. This convinced the steam railroad managers that they must turn to electric traction in order to retain their passenger traffic and compete with the light railways.

Charles P. Clark, former president of the New York, New Haven & Hartford Railroad Company, was fully convinced, as early as 1891, as shown by his report of that year to the stockholders, that the only effective way of checking this competition was to equip the lines affected with electric traction. He advocated equipping a branch line to demonstrate what could be done with electric traction on a standard steam railroad with a standard steam railroad equipment operated under standard steam railroad rules. This makes him the pioneer in electric traction as applied to steam railroads.

The New Haven system differs from every other important railroad property in this country, (*a*) in the immense volume of its passenger traffic, (*b*) in the large percentage of passenger revenue to total revenue, (*c*) in the large percentage of local revenue to total passenger revenue, (*d*) in the density of population in the territory served by its lines and (*e*) in the small area of that territory as compared with the mileage of the system. The company carried nearly 61,000,000 passengers in the year ending June 30, 1898, and the revenue amounted to over $17,000,000 from its passenger department, equivalent to over 51 per cent of the revenue from all sources. The system provides regular transportation facilities for about 6,000,000 people, and the density of population in Massachusetts, Rhode Island and Connecticut, in which nearly all its mileage is located, is 260 inhabitants per square mile—greater than that of any other State or section in this country.

Within its territory are found the two great cities of New York and Boston, with rich suburban residential areas tributary to their business centers, five other important cities with suburbs, and no less than sixty-five independent cities and towns of greater or less importance for manufacturing or residential reasons.

Owing to the close proximity of the cities and towns in its territory, the New Haven system had been seriously affected by this competition. The gravity of the situation was such that, in November, 1894, the management of the New Haven Road authorized the introduction of electric traction on the Nantasket Beach branch, the first installation of electric traction on a standard steam railroad. This was completed May 20, 1895.

At this time the Pennsylvania Railroad Company felt the effects of similar competition, and in 1895 authorized President George B. Roberts to introduce electric traction on the Bordentown & Mount Holly branch of its Amboy division. This installation was completed in July of the same year.

In the same year the Baltimore & Ohio Railroad Company had completed its tunnel under the city of Baltimore, and, in order to avoid the objectionable smoke and gases inseparable from service with steam locomotives, they decided to introduce electric traction on their belt and tunnel lines in the city of Baltimore.

In considering the application of electric traction to main lines, railway managers are confronted with the following questions, to which the writer appends answers, based on the experience of various roads on which electric traction has been introduced:

Can electricity be substituted for steam as a motive power on main lines of steam railroads?

Yes. But the value of electric traction on main-line steam railroads is wholly dependent on the style of equipment, manner operated, location of power station, method of power distribution and train service, and distribution of population in territory covered.

Can a main line so equipped be operated under the same rules as govern on standard steam roads?

Yes. The New York, New Haven & Hartford Railroad Company is operating by electricity traction 6.95 miles of double track, overhead trolley, from Nantasket Junction to Pemberton, 11.51 miles of double track third rail from Braintree to Cohasset, 3 miles of double track third rail from Berlin to New Britain, 18.6 miles of single track third rail from Hartford to Bristol, and 8 miles of single track, overhead trolley, from Stamford to New Canaan.

The Pennsylvania Railroad Company is operating 8 miles of double track, overhead trolley, from Bordentown to Mt. Holly.

The Baltimore & Ohio Railroad Company is operating 4 miles of double track, overhead trolley, in the city of Baltimore.

All the lines named above are operated under the same rules as govern the operation of steam trains on the other portions of the systems.

(*a*) Schedule speed has been maintained during times of heavy travel and frequent service.

(*b*) Train service has been reliable, and to a certain extent trains have been able to make up time.

Can same weight of train be operated?

Yes. Trains of the same weight have been operated by the three following methods:

(*a*) By using specially designed locomotives, as is done by the Baltimore & Ohio. This method has the disadvantages of great concentration of weight on roadway, and low efficiency when operating light trains. Where the service is infrequent or largely of freight, or where it covers a section of main trunk line through

* Abstract of paper to be presented at the International Railway Congress, Paris, Sept. 20-29.

service, such as that on the Baltimore & Ohio Railroad, then this equipment is the most desirable.

(*b*) By equipping standard passenger coaches with motors on one or both trucks and using these cars as locomotives to haul passenger trains. This style of equipment is used on the Highland, Hartford and Plymouth divisions, and New Canaan branch of the New York, New Haven & Hartford Railroad Company; also on the Bordentown & Mount Holly branch, Amboy Division of the Pennsylvania Railroad Company. Where the service is frequent and light, schedule speed moderate and station intervals sufficient to allow trains to reach full acceleration it has been demonstrated that this service can be operated satisfactorily. The simplicity and low first cost make this equipment desirable for this service.

(*c*) By equipping all or part of the coaches with motors mounted on motor trucks and operating them in trains controlled from the first, or any of the motor cars, as is done on the Alley Elevated Railway in Chicago. Where the conditions of operation require the maintenance of high schedule speed with frequent stops the problem resolves itself into one of acceleration and braking. These conditions are found mostly on the elevated railways of our large cities.

Can existing train schedules be maintained?

Yes. The service operated by electric motors on the Nantasket Beach branch of the New York, New Haven & Hartford Railroad Company during the summer of 1897 was the fastest ever operated over this branch, and one that could not have been operated with steam locomotives, as was frequently demonstrated during that year. This service is shown by the following official schedule.

Comparative speed of steam and electric trains on the Nantasket Beach branch of the New York, New Haven & Hartford Railroad Company.

	Length of Line	No. of Stations	Schedule Time	Average Speed
Steam, 1894	6 95 miles.	10	25 to 35 minutes	16.7 to 11.9 M. P. H
Electric, 1897	6.95 —	16	21 —	19.8 M. P. H.

Can stations be added without loss of schedule speed?

Yes. (See Appendix.)

Can a train of a given weight be accelerated more rapidly?

Yes. Owing to the steady torque of electric motors, at least 15 per cent of the weight on drivers is available for starting effort.

The test of the Baltimore & Ohio electric locomotives, which weigh 96 tons each, have shown a draw-bar pull of 60,000 lbs. on a dry rail, corresponding to a traction coefficient of over 30 per cent. Tests on a steam freight locomotive with 146,000 lbs. on drivers show a maximum draw-bar pull of 30,000 lbs., corresponding to a traction coefficient of 20 per cent or two-thirds of that developed by the electric locomotives.

A standard combination coach on the Plymouth division of the New York, New Haven & Hartford Railroad Company, equipped with four motors of 175 hp each, aggregating 700 hp and weighing complete 50 tons, developed 12,000 lbs. with an overload on the motors of only 25 per cent. Allowing a starting effort of 300 lbs. per ton weight of train, such a car could accelerate to a speed of 30 miles per hour in ten seconds, or allowing 90 lbs. per ton weight of train, could accelerate a train 130 tons to a speed of 30 miles per hour in thirty seconds.

A train of individual coaches each completely equipped with motors on all axles, operated from one control, would give the maximum acceleration possible, *i. e.*, that of a single unit with 100 per cent of its weight on the drivers.

Can an effective system of brakes be applied?

Yes. The Pennsylvania Railroad Company uses the full Westinghouse air-brake equipment; the Baltimore & Ohio Railroad Company uses the Westinghouse; the New York, New Haven & Hartford Railroad Company uses the Westinghouse and the Christensen brake with satisfactory results.

How will the electric air compressor compare in reliability and economy with the steam air compressor?

The Westinghouse, General Electric Company and Christensen air compressors have all proved reliable and fully as economical. The compressor, when using motors under car bodies, is placed on the platform of the open, in the baggage compartment of the combination and suspended under the closed coach, thereby allowing the motor car to be operated either as a single car or as a locomotive for drawing trains.

Can trains be provided with equally satisfactory train signals?

Yes. Whistles of the same power are blown from the air-braking reservoirs, and have proved satisfactory. Locomotive bells or heavy gongs are placed on cars and rung either by foot or hand power.

Can motor cars be equipped with pilots and headlights, complying with the statutory rules and regulations governing railroads?

Yes. The pilots can be attached to truck or coach body. Both electric and oil headlights are used, and are satisfactory. The New York, New Haven & Hartford Company uses oil in place of electric lights, owing to the loss of current when passing over grade crossings, where the third-rail conductor is cut out.

Can trains be operated over third rail during snow and ice storms?

Yes. The operation of the third-rail section of the Highland division of the New York, New Haven & Hartford Railroad Company during the last two winters has proved that passenger coaches equipped as electric locomotives, with nose plows and brushes, can handle snow as efficiently as steam locomotives with plows. The third rail is kept clear of snow by steel brushes mounted on the trucks ahead of the contact shoes. Ice, which gathers on the third rail during sleet storms, has proved more difficult to handle. Experience on this same division has shown that the use of a zero oil sprinkled on the third rail from the trains prevents the ice from freezing to the rail, so that it can be removed by the stiff steel brushes.

How will cost of operation be affected by more frequent service of lighter trains?

The service on the Highland division of the New York, New Haven & Hartford Railroad Company is frequent, with light trains, while the service on the Berlin branch is not so frequent and with heavier trains. A fair answer to this question will be a comparison of the train miles run on each branch and the cost per train mile.

Daily train miles, Berlin branch = 66.
Daily train miles, Highland division = 737.
Cost per train mile, Berlin branch = 30.3 cents.
Cost per train mile, Highland division = 12.5 cents.

How will cost of operation be affected by the form of power transmission?

(a) By overhead or underground trolley?
(b) By simple or sectional third rail?
(c) By direct or alternating current?
(d) By static or rotary transformers?
(e) By direct or alternating current motors?

The local conditions govern the form of power transmission.

(*a*) The overhead trolley form has proved to cost more to install and maintain than the simple third rail, and to be less economical to operate. The first cost of the underground trolley and the difficulties encountered in draining make its use prohibitive on main railways.

(*b*) As the simple third rail, charged throughout its length, has been the only form in use on main lines, no data as to the economics of the sectional or safety third rail can be obtained.

(*c*) On main railways, where the distribution of power does not exceed a distance of 10 miles to 15 miles, the direct current has proved economical. In lines where power must be transmitted over a greater distance than 10 miles to 15 miles the alternating current should be used.

(*d*) When alternating-current motors can be designed to give a satisfactory starting torque, then alternating currents may be transmitted from the central stations through static transformers direct to the motors. At present transmission with alternating currents requires the use of rotary converters for conversion to direct current when delivered to the working conductors.

(*e*) When the development of the alternating-current motor shall enable it to compete with the direct current, then there will certainly be a large saving for transmission over long distances, and the equipping of main trunk lines will follow.

How will cost of motive power per train mile with motor cars compare with steam locomotives?

A comparison of the figures obtained from the operation of the several power stations, and from the performance sheets of steam locomotives of the New York, New Haven & Hartford Railroad Company, shows the cost of motive power per train mile to be as follows:

Steam locomotives = $0.19 to $0.24.
Highland division = $0.0604.
Nantasket Beach branch = $0.1441.
New Canaan branch = $0.0783.
Berlin branch = $0.1406.

The cost of electric motive power shown above includes the operation and maintenance of power stations, the maintenance of motors and other equipment on the cars, oil, grease and waste used on the cars, and the wages of the motormen who operate the cars. The cost of steam motive power includes fuel, oil and waste,

maintenance of locomotives and the wages paid the men who operate the locomotives.

How will cost of operation per train mile with motor cars compare with steam locomotives?

The total cost of operation per train mile with electric motor cars (excluding interest and depreciation) on the New York, New Haven & Hartford Railroad is as follows:

Berlin branch = $0.3032.
Highland division = $0.1255.
Nantasket Beach branch = $0.2925.
New Canaan branch = $0.1754.
Figures for operation with steam cannot be obtained.

How will cost of train labor compare?

Cost of train labor per train mile as shown from operation with electric traction on lines of the New York, New Haven & Hartford Railroad Company is as follows:

Train labor Berlin branch = .18.
Train labor Highland division = .027.
Train labor Nantasket Beach branch = .0829.
Train labor New Canaan branch = .063.
Train labor with steam, per train mile, about .12.

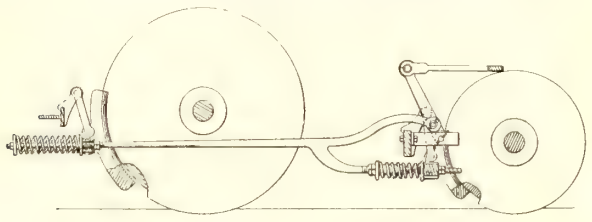
(To be Continued.)

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED AUG. 14, 1900

655,682. Car Seat; F. Bennett, New York, N. Y. App. filed Dec. 20, 1897. The back and seat are so connected through suitable levers that when the former is swung from one side to the other the seat will be shifted slightly in the opposite direction.

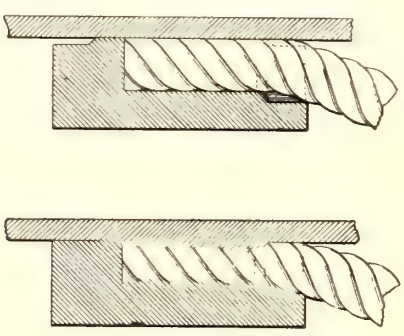


PATENT NO. 655,754

655,738. Car Spring; W. Robinson, Boston, Mass. App. filed Dec. 31, 1896. An arrangement of light and heavy springs intended to make the riding equally easy whether the load be light or heavy.

655,754. Differential Brake Mechanism; J. A. Brill and W. S. Adams, Philadelphia, Pa. App. filed March 3, 1897. This is a brake mechanism for applying different braking stresses to the large and small wheels of a truck having large driving wheels and small guiding wheels.

655,771. Car Seat; M. N. Forney, New York, N. Y. App. filed April 13, 1899. When the back is reversed, two oppositely located foot-rests are reversed at the same time.



PATENT NO. 656,125

655,839. Car Step; J. B. Thacher, Albany, N. Y. App. filed Oct. 20, 1899. Two steps are arranged so that the lower one must be entered by the passenger moving at right angles to the length of the car, while the next one is entered by moving parallel to the length of the car.

655,863. Sand-Box for Cars; A. W. Ham, Lansingberg, N. Y. App. filed Feb. 26, 1900. Two distributing spouts of different capacities, with mechanism for controlling each, are used.

656,030. Trolley for Electrically Driven Vehicles; L. Lombard-Gerin, Lyons, France. App. filed Jan. 9, 1900. An automotor-trolley, comprising an apparatus provided with a shaft having contact-rollers adapted to travel on conductors insulated one from another, the said apparatus having a motor possessing a fixed inductor and a movable armature, the periphery of which directly actuates friction-rollers on the shaft of the contact-rollers.

656,125. Bond for Track Rails; H. F. A. Kleinschmidt, Johnstown, Pa. App. filed Dec. 28, 1899. The end of the bond is placed in a groove in a metal block and then welded thereto.

656,133. Truck-Wheel and Armature Exchange for Street or Other Railway Cars; W. H. Cornner, Anderson, Ind. App. filed Nov. 23, 1899. A track passing over a pit is provided with a movable section arranged to be lowered and raised in the pit for the purpose of facilitating the mounting of parts of the car.

11,845. Reissue; Pneumatic Device for Clearing Railway Track Sanding Pipes; J. H. Hanlon, Boston, Mass. App. filed Sept. 19, 1899. Means are provided for directing a blast of air through the discharging nozzle of the sand-box, in order to clear it out.

PERSONAL MENTION

MR. E. G. LONG, of the Peckham Truck Company, has returned from a business trip to Europe.

MR. EVERARD HOLMES has been elected secretary and treasurer of the Interstate Consolidated Street Railway Company, with office at Pawtucket, R. I., to succeed Mr. E. R. Price, who resigned June 30.

MR. A. C. THOMPSON, of St. Louis, has been appointed superintendent of the St. Louis & Belleville Traction Company's lines between Belleville and East St. Louis, vice Mr. Thomas M. Sneed, who resigned several months ago.

MR. THOMAS NEELY has resigned as general superintendent and chief electrician of the Vicksburg, Miss., Railroad, Power & Manufacturing Company to accept a similar position with the Meridian Street Railway & Power Company, of Meridian, Miss.

NEWS NOTES

[*News notes for this department are solicited.*]

DENVER, COL.—The Denver City Tramway Company will make alterations and build an addition to the depot at Broadway and Alameda Avenue for the purpose of establishing a club room for the employees. A reading room and gymnasium has been established by the company in North Denver. The building on Broadway is 38 ft. x 50 ft. and is built of brick. The addition will cost $1000. Magazines and papers will be kept on file, and there will also be a small library.

HARTFORD, CONN.—The conductors and motormen of the Hartford Street Railway Company have been furnished with new cap medallions. Those for the conductors have black letters on a white ground and a border of gold. The motormen's medallions have white letters on a black ground and the border is of silver. The figures and background of each are of enameled leather. They are larger than the kind formerly in use and much more attractive. The employees deposit 75 cents with the company when they receive a medallion, and when they leave the service of the company they return the article and get their 75 cents back.

WASHINGTON, D. C.—There was a rear-end collision of two cars of the Great Falls line of the Washington Traction & Electric Company a few days ago. A number of passengers were slightly injured.

WASHINGTON, D. C.—About sixty new cars have been ordered by the Washington Traction & Electric Company. They will be unlike any now in use in that system. The body will be 28 ft. long, with cross seats. The window sills will be low, so that in summer the sashes can be lowered, with the effect of an open car, and in this way the same car can be available for all-the-year-round service.

ATLANTA, GA.—The lines of the Atlanta Railway & Power Company were tied up for two and one-half hours on Aug. 12. The suspension of traffic was caused by the burning out of an armature of one of the large machines in the company's plant and by the demolition of an overloaded engine which was making an effort to supply power to handle a sudden rush.

MUSCATINE, IA.—The Muscatine Electric Railway Company has submitted a proposition to the City Council offering to expend $100,000 in improving its property and extending the lighting and railway service provided the city will grant the company a ten years' extension of the lighting contract and a twenty-five year extension of the railway franchise. The company, if granted the desired franchises, will obligate itself to expend every dollar of the sum specified, the intention being to put in an entirely new power plant at a cost of $75,000, a new gas plant to cost $15,000, and two extensions of the electric railway line, and further agrees to erect a pavilion in Weed Park to cost between $4500 and $5000, with a seating capacity of 500, and adapted for use by dancing parties, comic operas, and summer attractions of various kinds.

Street Railway Journal

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OPERATING METHODS OF THE COLUMBUS RAILWAY COMPANY

Columbus is practically the geographical center of Ohio; it is the greatest railroad center in the States, and is the State capital. Located here are the State House, the State penitentiary, institutions for the blind, insane and feeble-minded and deaf and dumb; there are also here United States barracks, accommodating 6000 soldiers. The city has a population of some 150,000 people, making it third in the State, and it includes within its corporation boundaries 16¼ square miles of territory. A large number of societies hold their conventions at Columbus, and, owing to its many attractions for the Ohio citizen, the number of excursionists who visit it throughout the year is very large.

VIEW ON HIGH STREET, SHOWING METHOD OF ARCH ILLUMINATION

The engraving on this page gives a view of one of the principal thoroughfares in the city, High Street, and also illustrates the ingenious and attractive method of illuminating the street by arches. These arches are placed at intervals along High Street from the Union passenger station to Livingston Avenue, a distance of about 7400 ft., being twenty-five in number. The spacing varies somewhat, according to the length of the different squares. The arches are supported upon the steel side poles of the railway company, the support beginning at a point about 16 ft. or 17 ft. above the pavement. The center of the arch is about 26 ft. above the roadway. Each span carries fifty 16-cp incandescent lamps, the receptacles for which are wired in a hood extending beneath the arch; this hood is painted white. The current is furnished by a local electric light company, payment for which is made up by an appropriation from the city of a certain sum, and subscriptions from the various property owners and store keepers along the street. The cost has been put very low, being $19 per month per arch. The lamps are lighted every night during the year. This is in addition to the regular arc lights. The weight of the arch proper, *i. e.*, the steel work, is ap-

proximately 1000 lbs., and the cost was about $150. This does not include the wiring and the lamps. This method of street illumination has been favorably commented upon by visitors to Columbus, and is one of which the residents along the streets feel justly proud. In another section of the city, called the "Hub," located in the vicinity of Fourth and Main Streets, this arch system of lighting is also used, but upon a smaller scale.

The Columbus Railway Company owns the entire street railway system, the lines of which radiate in all directions from the city's center with a total length of 98 miles. In addition to the city lines the company operates an interurban road from Columbus to Westerville.

The company, appreciating that street car riding is as much habit as necessity, encourages patronage in many ways. Visitors are informed by a sign at the entrance to the Union Railroad Station that a map of the city may be had for the asking. This is the street railway company's folder, and contains a map of the city, handsome views of the chief points of interest and comprehensive instructions for reaching them. Excursion trains are met by representatives of the company and these folders given out freely to all visitors. In this way some 60,000 have already been distributed this season. In addition to the folders the company publishes a handsome 52-page illustrated guide to the city and pleasure resorts, with map and street railway directions. These are mailed to Sunday schools, societies and others throughout the State, and assist in making up sight-seeing routes. The company believes that this advertising not only brings many people to Columbus who would not otherwise come, but by helping them to economize their time while in the city, results in their riding more often on the street cars.

To further encourage patronage, the company operates two pleasure parks. Olentangy Park has few equals in natural beauty. It contains 37 acres, and is cut across by numerous deep ravines, so shaded by overhanging trees that the sun rarely gets into them. Along one side of the park runs a branch of the Scioto River, affording splendid boating and delicious bathing. One of the most popular

features of the resort is the toboggan slide, which is a "shoot the chutes" on a small scale. Each bather rents his own toboggan, which he must himself carry up the incline. Added to the exciting ride down the incline is the pride of sliding furthest over the water before the toboggan sinks. Although the park is thick with trees, it is well lighted at night by a multitude of incandescent lights, even the river being illuminated throughout the length of the park. Disregarding the popular notion that people who have a chance to sit down do not spend their money, the park is everywhere furnished with comfortable benches. The most prominent of the buildings is the magnificent theater, whose spacious veranda, surrounded by a dense growth of trees, overhangs the Olentangy River 50 ft. below. The theater building is 80 ft. x 250 ft.; the auditorium is large, cool and comfortable, seating 2248 people. Ice water is supplied free from suitable tanks placed at convenient points through the grounds.

Minerva Park covers 150 acres. It is not so favorably located as Olentangy, but the same care is exercised to make it a popular and pleasant pleasure ground. It has bowling alleys, scenic railway, "shoot the chutes," etc., and a theater seating 2500 persons. This

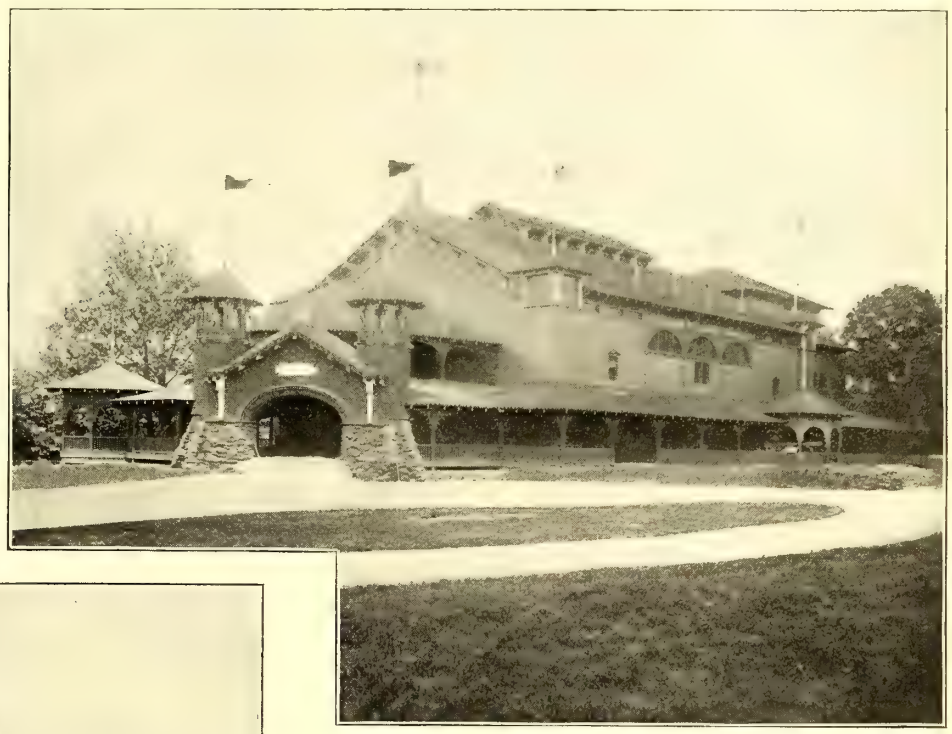
GATEWAY TO OLENTANGY PARK

park is forty minutes out from the city, a 15-cent fare for the round trip being charged, which includes admission.

The company's rolling stock is maintained in the best possible condition, with the fact in mind, as stated above, that many people ride for pleasure or from habit, and clean, comfortable, handsome cars go far toward increasing the road's receipts. The car equipment consists mainly of double-truck cars. Owing to the wide gage (5 ft. 2 ins.), the company uses the bicycle truck under all its double-truck cars. The standard box car is 28 ft. inside, with 4-ft. 6-in. platforms, the standard open car is 36 ft. over all, with twelve seats, and vestibuled. The company much prefers the vestibuled to the ordinary type of glass front. Following what is now very general practice, the company has party cars, which are rented by the hour or evening.

The repair shops are located in a large and well equipped building. Among devices of interest is a circular crane for handling trucks, motors, etc., and fully illustrated in the accompanying engraving. It is the intention of the company to equip this circular crane—as well as the car body hoisting trolleys—with compressed air hoists. Christensen direct-connected motor compresser and air hoists are to be used. A device for making armature coils is also shown. The reducing gear is for the purpose of giving a slow speed and avoiding any back lash.

The company has had excellent success in splicing cars. Twenty of these have been in service for four years, and



THEATER AT OLENTANGY PARK

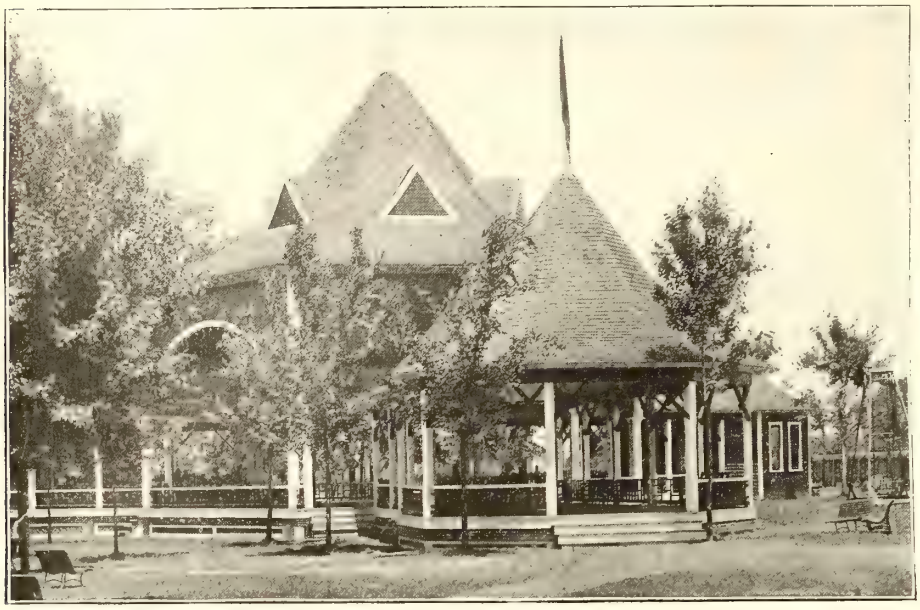
are apparently in as good condition as when the work was done. They are of special value, owing to their large carrying capacity and light weight. The spliced car bodies weigh a little over 9000 lbs., while new bodies of the same dimensions, which the company recently bought, weigh slightly over 14,000 lbs.; in other words, the spliced cars carry just as many people and weigh but little more when loaded than the new cars when empty. A working diagram is given, showing the general plan for splicing cars, with the arrangement of timber before covering over.

For use on interurban roads the company has spliced together two 22-ft. side seat combination cars, making a car body 42 ft. long. These cars were spliced in the same manner as shown in the accompanying plan, except that two 6-in. I-beams, filled in with oak on each side and running the full length of the car, have been added to provide for the heavy strain of interurban service. These cars have twenty-six seats upholstered in red plush, and seating fifty-two passengers. The cars are lighted by electricity and Pintsch gas. The company owns its own Pintsch gas plant, from which it supplies the gas to its interurban and private cars, and also to the steam railroad companies passing through the city, piping the gas from the plant to the Union Depot, about a mile away.

Another sketch shows the method of cleating wires under the side of the car in preference to using a cable the entire length. The wires are cleated, as shown, the full length of car underneath side seats, entering a cable at the ends which carries the wires under the platform to the con-

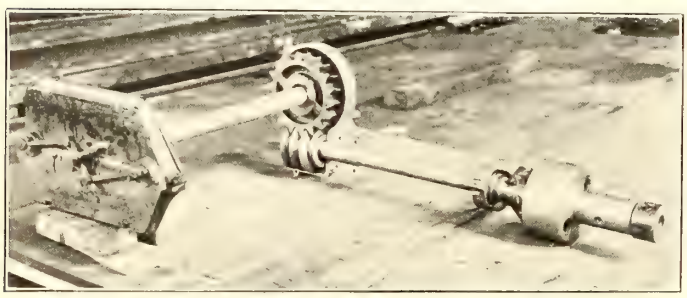
troller. All wires where passing through the floor or timbers of the car are protected by porcelain bushings. These porcelain bushings are considered a very important feature and have done much to increase the efficiency of the wiring. The total maintenance cost for all rolling stock is less than 1 cent per car mile.

Each car is fitted with an automatic fender, which costs, complete, $18. The company believes thoroughly in the use of fenders, and that they save many lives and serious accidents. One interesting case on record is that of a bicyclist who was struck by a car running at full speed. Both man and wheel were caught on the fender under the car, and when pulled out were unhurt, the man riding away on the wheel.

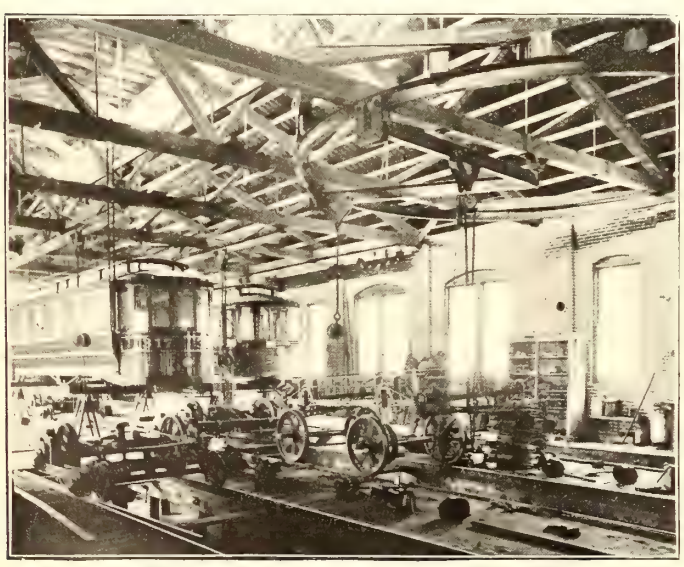


PAVILION IN MINERVA PARK

ENTRANCE TO MINERVA PARK

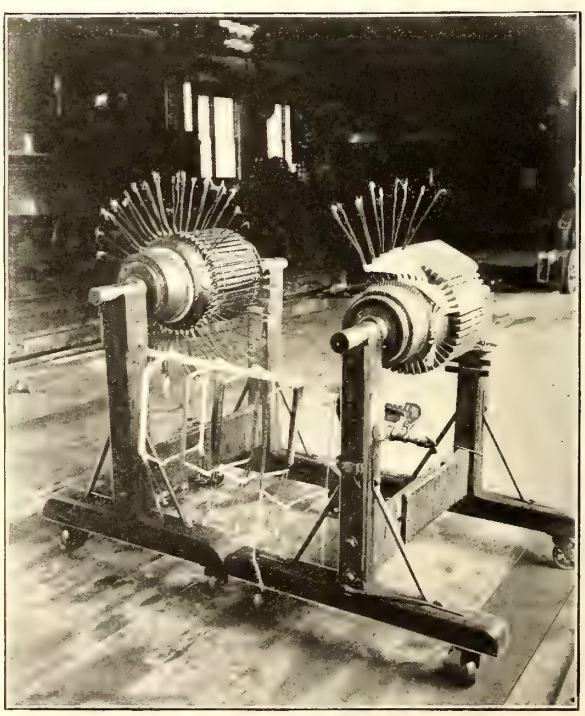


GEARING FOR WINDING ARMATURES



CIRCULAR CRANE IN ROSE AVENUE SHOPS

Trolley wheels, trolley harps and journal bearings are made in the company's own brass foundry. Trolley ears 14 ins. long cost 16½ cents apiece. Armature bearings have a composition of 80 per cent copper, 12 per cent lead, and 4 per cent each of phosphorus tin and pig tin, and show a life as high as three years. The journal bearings are bored in special design jig, which bolts on to the carriage of a lathe, using a boring bar with four cutters, viz.: A cutter at each end for facing the ends of brasses, a roughing cutter, which roughs out the work, and a finishing cutter, which sizes the brass. With this arrangement it is not necessary to caliper the brasses, except when setting the cutter; one setting of the finishing cutter will bore some-

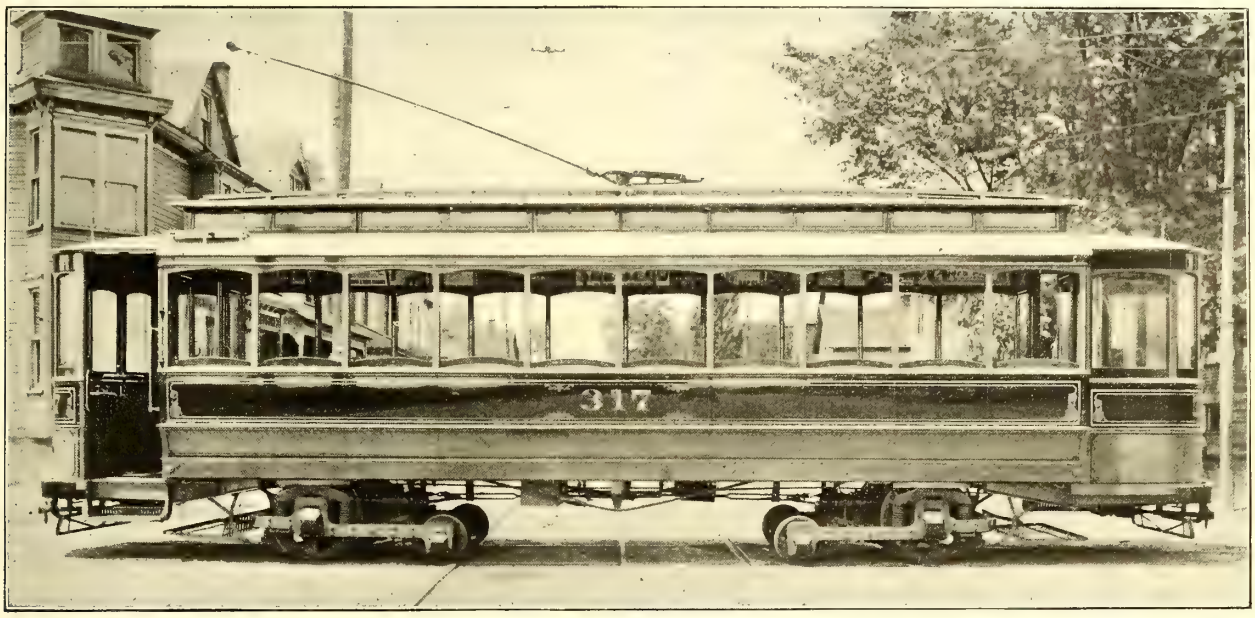


RACK FOR WINDING ARMATURES

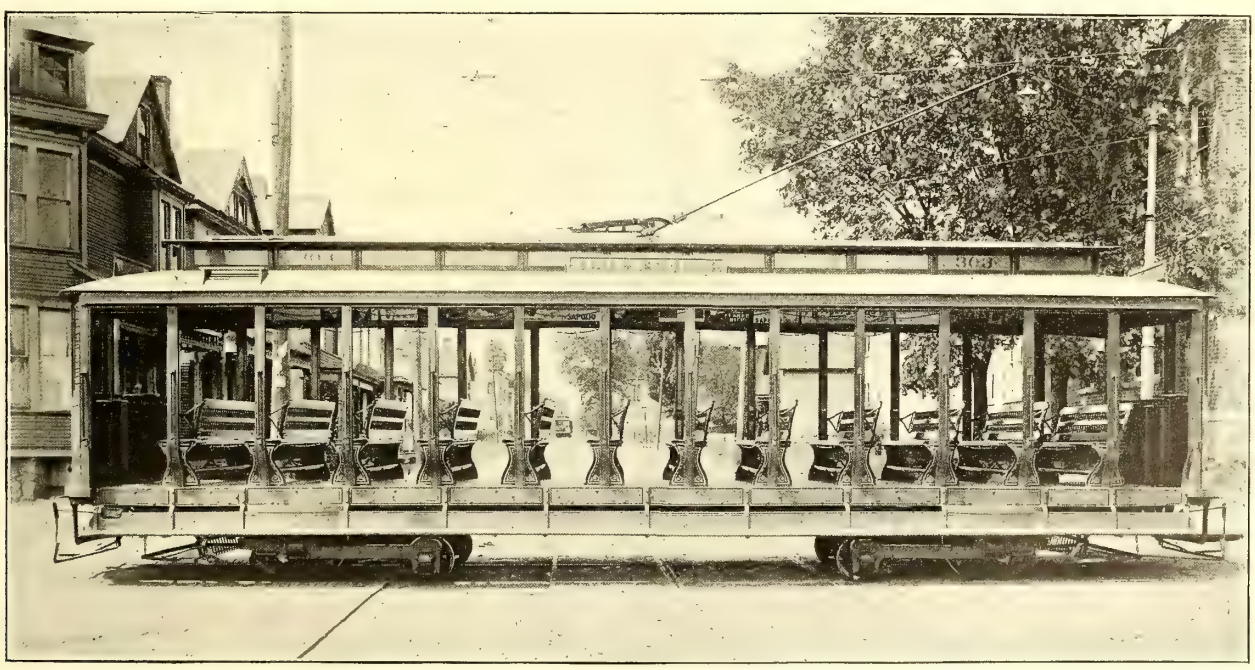
times as many as fifty bearings before needing sharpening.

The company's standard for new track and roadbed construction is 74-lb., 8-in. T-rail, laid on oak ties. The ties are laid on a bed of broken stone, which is also tamped in between up to within about 2 ins. of the tops of the ties. Then a layer of cheap concrete, flush with the tops of the ties. This is to keep the sand in which the paving blocks are imbedded from sifting down into interstices between the blocks of broken stone. This practice has greatly improved the quality and life of the pavement. The company paves to a foot outside of its rails. There are a large number of cast-welded joints on the system, and more will be put in this fall. They were put in by the Milwaukee Rail Joint & Welding Company, and the railway company itself, which now owns its own welding outfit. These joints have given excellent satisfaction.

In connection with the track work it should be stated that data relating to this department are kept in a very systematic manner. In general the idea is to get all the information which a manager would want in as concise a form as possible, and in a way which would require but a small amount of work to keep up. The record is divided into two sections: The first shows straight track, location of special work, kind of rail, pavement and joints; the second part is devoted to details of special work. Distances on straight track sheet are noted by 1000-ft. stations. Cross streets are not shown, only the exact location of the intersection of the cross street nearest each 1000-ft. station. Points of special work, curves, change of rail section and change of pavement, or a change in the kind of joints are noted in feet, counting from the preceding 1000-ft. station. In the special work record a sketch is made of each piece of work, noting joints and giving each frog and switch the same number as that in the original shop drawing from which the work was made. The connecting rails are also noted, so that special splice bars can be made at any time without disturbing the track until they are ready to be put on. Adjacent to each sketch is placed the name



STANDARD CLOSED CAR



STANDARD OPEN CAR

of the company by which the work was made, height of rail, original drawing number, weight of rail and maker's section number and the time work was laid. Renewals or repairs which were made to this work are also added as made. These records are all drawn on tracing cloth, from which blue prints are made once a year, and bound in a special binding made to fit the sheets; in this way the tracings are not handled at all, and form a permanent record.

METHOD OF SPLICING TWO 16-FT. BOX CARS

CAR MADE BY SPLICING TWO 16-FT. CARS

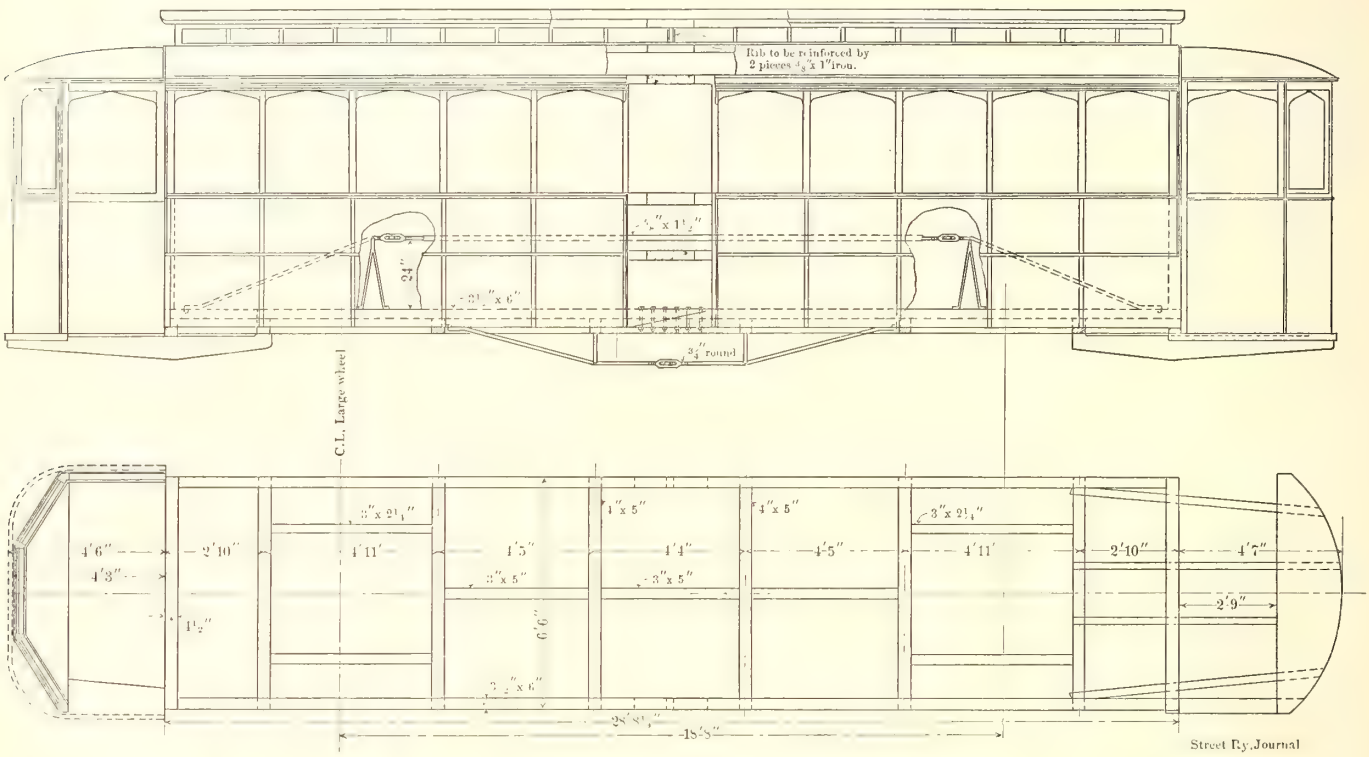
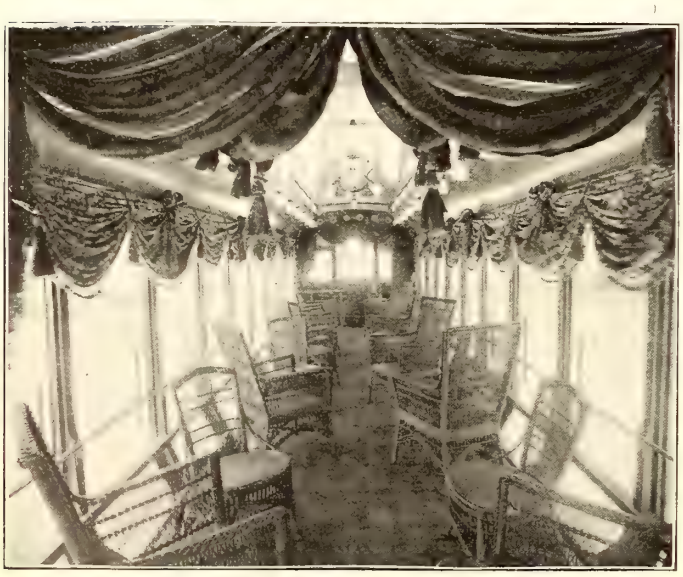


DIAGRAM SHOWING METHOD OF SPLICING CARS



INTERIOR OF TROLLEY PARTY CAR

VIEW ON NEIL AVENUE, USED LARGELY FOR EVENING PLEASURE RIDING

Changes in this record are noted upon the tracing from track foreman's report. Once a year the entire record is very carefully gone over and verified.

On the Westerville interurban line is installed an interesting automatic signal, designed for use between

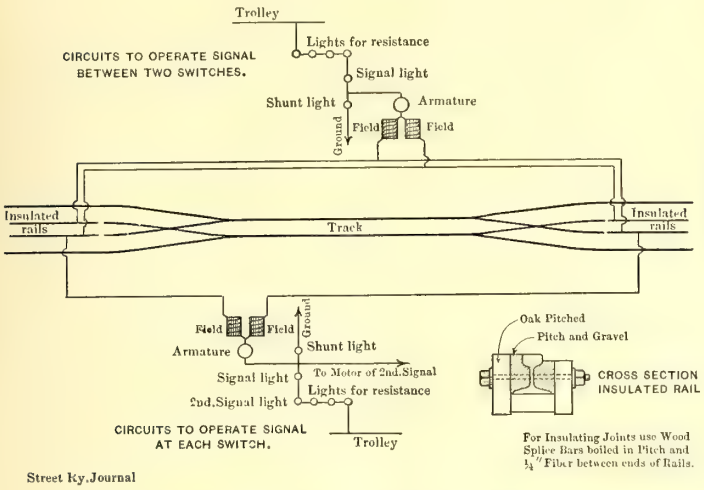
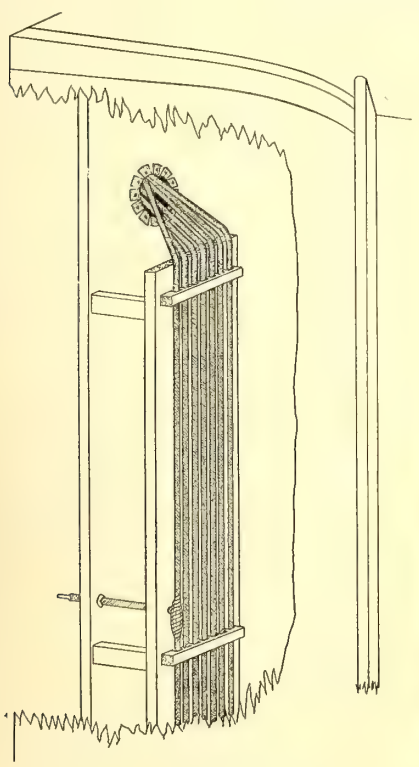


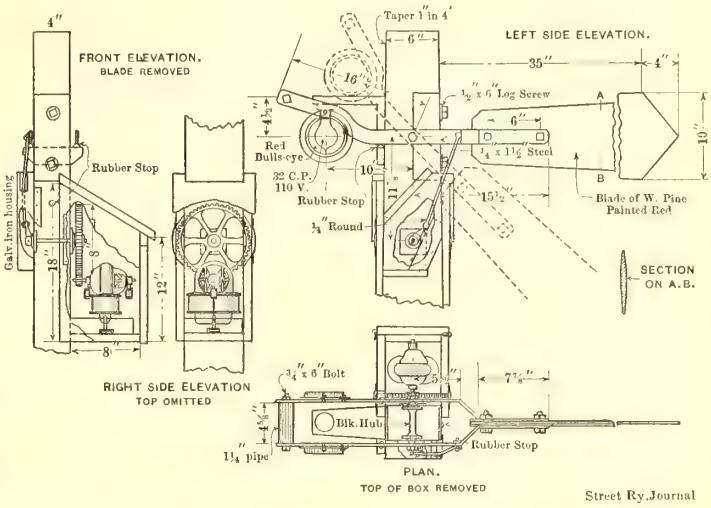
DIAGRAM SHOWING CONNECTIONS FOR SIGNAL

switches. This signal is thoroughly reliable, and a great assistance in the operation of the road. The design is somewhat crude, yet very substantial and positive. The signal arm is carried on the spindle of an ordinary bicycle wheel hub, the hub being securely fastened in the post, and the spindle to the side of the arm revolving in ball bearings on each end. This arrangement gives a very sensitive arm, and the side bearing prevents wind pressure from the side having any material effect upon its operation.



METHOD OF CAR WIRING

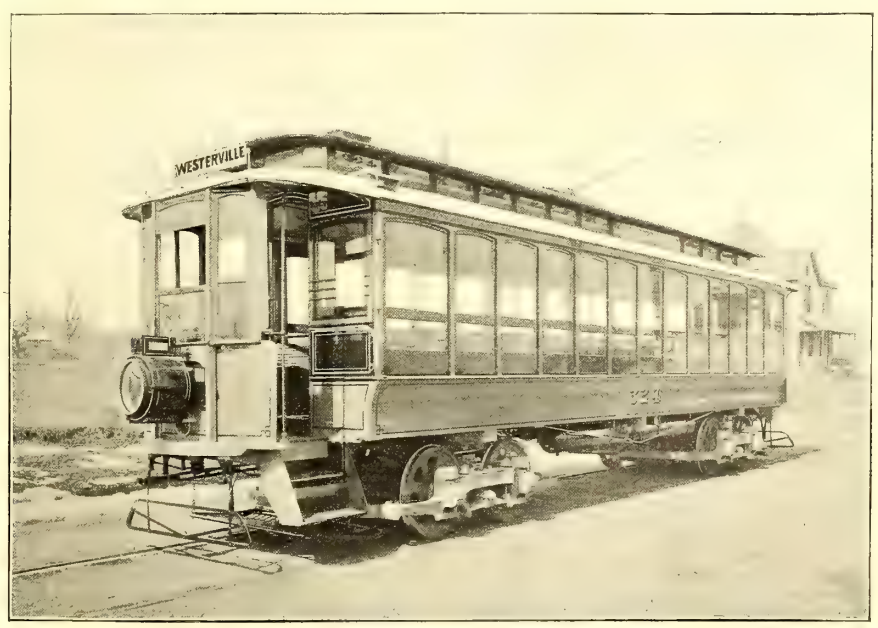
One end of the arm is made of white pine, painted red; the other end has two red bull's eye lights which cover or expose an incandescent light for night signal. The arm is operated by a Western Electric Company's 16-in. fan motor, geared to a countershaft, which is connected to the arm by a small crank and connecting rod. The crank is arranged to make a little more than half a revolution to throw the target from up to down. This signal forms a very simple locking device, and gives a maximum torque to start arm either up or down. The signal is operated by the wheels of the car passing on to an insulated rail, which rail is connected to the motor, axle



BLOCK SIGNAL

and car wheels, making the ground connections between insulated rail and ground. This circuit is clearly shown in the accompanying sketch. One field coil of the motor is used to throw target up and the other field coil so connected as to operate arm in other direction. The signal motor is shunted around a 50-volt lamp, which gives only 50 volts between insulated section of rail and the ground; in fact in actual practice the voltage is not even this high, as enough leakage will take place to reduce this voltage to about 30 volts, which is too low to be noticed by coming into contact with rail.

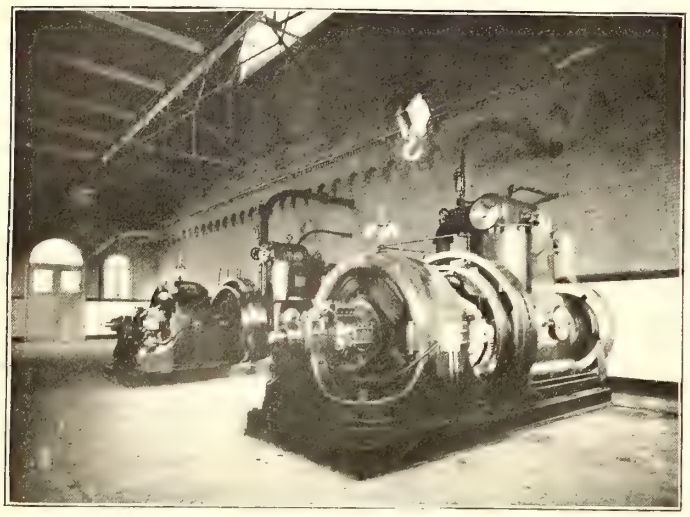
The company has two power houses, one of which was



INTERURBAN CAR ON WESTERVILLE LINE

acquired by purchase, and is used largely as an auxiliary. The first, the Spring Street station, has two Buckeye tandem compound-condensing engines of 750-hp each, direct-connected to G. E. 500-kw generators. This station has also one cross-compound Green-Wheelock engine of 1200 hp, direct connected to an 850-kw G. E. generator; three McIntosh & Seymour tandem compound engines of 300

hp each, belted to G. E. generators; Wheeler surface condenser, Cockran oil separator and Babcock & Wilcox boilers. There is also an automatic gravity oiling system, which was installed several years ago, and was one of the first in the State; the drips all run back to the oil room through a waste and sand filter, and from the storage tank

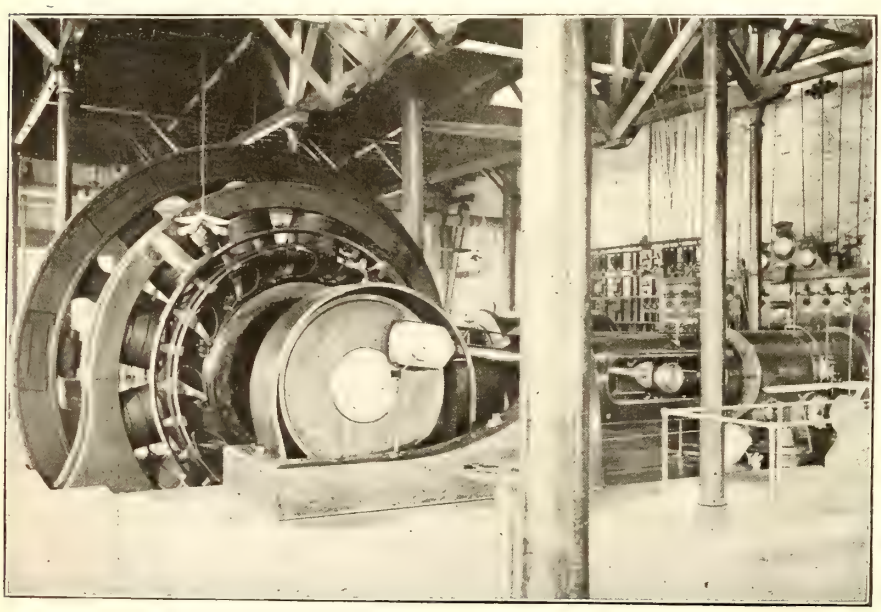


INTERIOR OF MILO POWER STATION

the oil is pumped back to the pressure tanks located in the engine room.

The Milo station is equipped with eight Stirling boilers, aggregating 2400 hp, Murphy furnaces, Green economizer and three Westinghouse engines, aggregating 1100 hp, direct-connected to Westinghouse generators. At this station there is installed a We Fu Go purifying system, which has given excellent satisfaction, having done away entirely with the necessity of cleaning the boilers.

The Columbus Railway Company has had no trouble



INTERIOR OF SPRING STREET POWER STATION

with its employees for many years. A graded schedule of wages for motormen and conductors is in force. For the first three months in the company's service the employee received 15¾ cents per hour; for the next nine months 16¼ cents per hour, and 17¼ cents per hour thereafter. Men who have been in the company's employ for six months are paid the same interest on their earnings for each six months as is paid on the preferred stock of the company. Men who have served for five years receive each year thereafter one free uniform, and as a mark of such service are allowed to wear a gold band upon the arm. After ten years of service another gold band is added on the arm and the company issues to the man without charge two uniforms per year. Fifty per cent of the company's men have one or more bands. The qualifications necessary to a successful application for the position of motorman or conductor are good health, good moral character, good eye sight without spectacles, hearing, heart and lungs sound, free use and movement of hands, arms and legs; age between twenty-three and forty years; must weigh not less than 150 lbs., if an applicant for conductor, or not less than 175 lbs., if applicant for position as motorman, and height must exceed 5 ft. 9 ins.

The Columbus Railway Company was incorporated in Aug. 18, 1889, and is a consolidation of the Columbus Street Railway Company, chartered April 25, 1892; the Crosstown Street Railway Company, chartered Feb. 24, 1893, and the Columbus Central Railway Company, chartered March 8, 1893. The company is capitalized for $7,000,000, half of which is common and half preferred stock. The property has a mortgage indebtedness of $5,086,000. The officers of the company are: President, Robert E. Sheldon; first vice-president and treasurer, Edward K. Stewart; second vice-president, Clarence M. Clark; secretary and auditor, P. V. Burington; general superintendent, M. S. Hopkins.

Trial Trips on the Wannsee Bahn

At last trial trips are being made with electric trains on the Wannsee road, near Berlin, which has been equipped by Siemens & Halske. Each train consists of nine three-axle passenger cars, each having five compartments for ten passengers each. The first and last cars have a motor on each axle, or a total of six motors. In starting, the two groups of three motors are each connected in series. As soon as a certain speed has been attained the motors on the last car are cut out. The train, which is being used for experimental purposes only, at present, is fitted with measuring instruments, which show the current consumption at all times. To compare the cost of electrical operations with steam locomotive service, the same class of measurements are made on the steam locomotive. It has been found that at the start the motors consume 200 amps., the average power at the start is 600 hp, and during the run about 300 hp is required. The time taken to get the train up to full speed (40 km per hour) from a standstill is ninety seconds, while during this time the train passes over a distance of about 500 meters. The train is completely braked in thirty seconds within a distance of 170 meters. According to this, the distance between Berlin and Zehlendorf being 12 km, the trip can be made in twenty-seven minutes, and the stops about one minute in length. This schedule must be adhered to when the train is fully loaded, *i. e.*, twenty-nine axles, 220 tons, including the weight of the 410 passengers.

M. K. McMullin, of Pittsburgh, has purchased control of the West End Traction line of that city. It is supposed that the road has been bought in the interests of the Union Traction Company.

The Metropolitan Railway of Paris

A glance at a map of Paris showing the omnibus and tramway lines of that city would appear to indicate a system of transportation so complete and so well calculated to meet every requirement that any additional facilities to this end would be unnecessary. No matter what part of the city a person may wish to visit or where the starting point may be, there is a possibility of reaching the destination with very little trouble—with or without transfer to another line—provided the traveler has an intimate acquaintance with the routes followed by the various "busses" and tramcars and understands the eccentricities of the transfer system. Every important street has, in fact, one or more lines of cars for the use of the public, and the grand boulevards are crowded during the busy hours with omnibuses from all the principal quarters of Paris. The only relief from this congestion of traffic lay in diverting a portion of it into other channels; and, since an elevated structure would be quite out of the question in a city which prides itself on the beauty of its streets, the only alternative was an underground railway. It is many years ago since such an undertaking was first considered, but really definite action was not taken until after the last Exposition. It may be that the need for better transit facilities was felt when the influx of visitors occurred at that time, but the only satisfactory solution of the problem presented itself when electric traction became a practical method for application to transportation systems, and when there was no longer any doubt as to its reliability and its many advantages for underground work

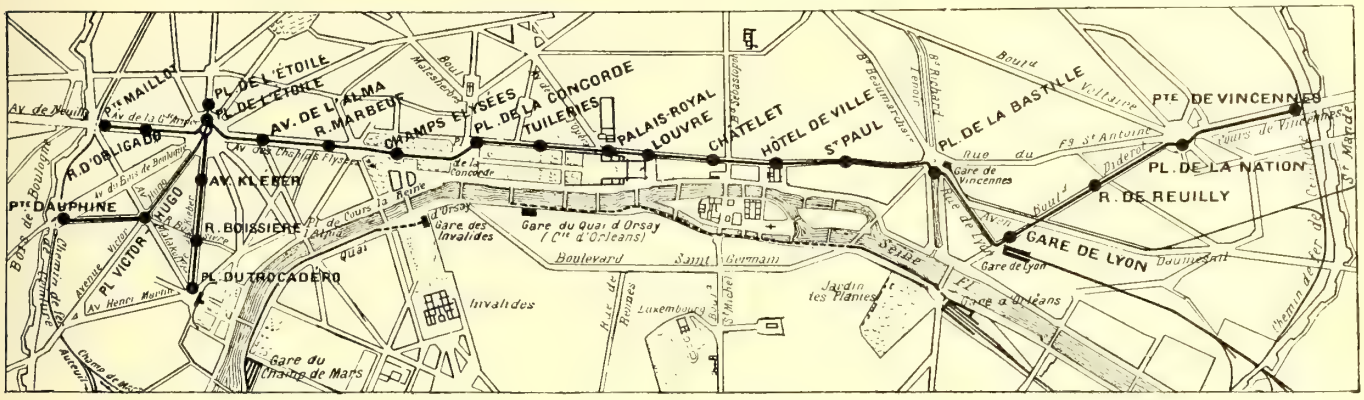


FIG. 1.—MAP OF PRESENT SECTION, PARIS METROPOLITAN UNDERGROUND RAILWAY

Four years ago the city authorities decided to build a metropolitan railway. They appeared to be particularly desirous that their road should be independent of the railroads of the State; therefore, they concluded that a narrow gage track should be used, this requirement having the additional advantage of reducing the expense of building the road. However, a State law passed in 1898 authorizing the city of Paris to build the railway, specified that the standard gage of 1.44 m should be employed. The maximum width of the cars over all was given as 7 ft. 10½ ins., and a clearance of 27 ins. was required between car and tunnel wall at a height of 6 ft. above the rails.

The Metropolitan Railway as at present projected will be remarkably comprehensive in service, and will form a network of lines almost rivaling those of the surface. The first to be constructed is one running from the Bois de Boulogne on the west to the Bois de Vincennes on the east, traversing the city through the center and following the right bank of the river for a considerable distance. Another line is to be constructed following the old boulevards and forming an irregular figure called by courtesy a circular path. This supplements the Ceinture, or Belt, Steam Railroad, which passes around the city on the inner side of and close to the fortifications. It may be compared to the inner circle of the London Underground Railway and will doubtless be of great value, passing as it does through the center of the Southern district and through the thickly populated sections in the northern part of the city. The third important line runs from east to west a little to the north of the first-mentioned line, and a fourth passes through the center of the city from north to south. Two other lines are to be built, one to provide direct communication with the different trunk railways having termini in the eastern part of the city; the other to be mostly open cut or elevated, and but little underground, connecting the Vincennes line with the belt line at its southernmost point. The three lines which pass through the city from east to west or north to south have their terminal points at the Fortifications' Belt Line, or Ceinture Railroad, which will give additional transportation facilities.

The whole network of the system is not yet under construction, as it was decided to undertake the work by sections. The most important line, especially in view of the Exposition, was that connecting the western part of the city with Vincennes, where the machinery and transportation exhibits are installed. This line, which is that shown on the map, starts at Porte Dauphine, one of the city gates leading to the Bois de Boulogne, and passes through the Place de l'Etoile, then down the Champs Elysées past the Tuileries and the Louvre, through the city to the square where once stood the Bastille, and on to the gate of Vincennes. In order to accommodate the

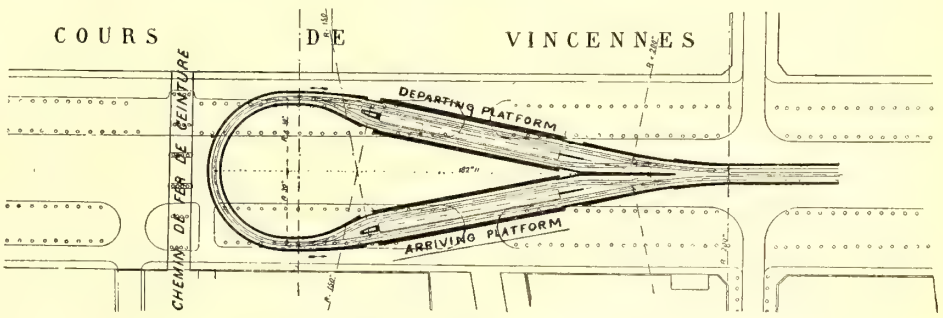


FIG. 2.—PLAN OF LYON STATION, SHOWING PLATFORMS FOR ARRIVING AND DEPARTING TRAINS

crowds of people desirous of visiting the Exposition, a branch line has also been carried to the Trocadero from the Place de l'Etoile, as shown, this forming part of a circular line to be built in its entirety only after the close of the Exposition. An extension down the Avenue de la Grande Armée to Porte Maillot has also been made. The

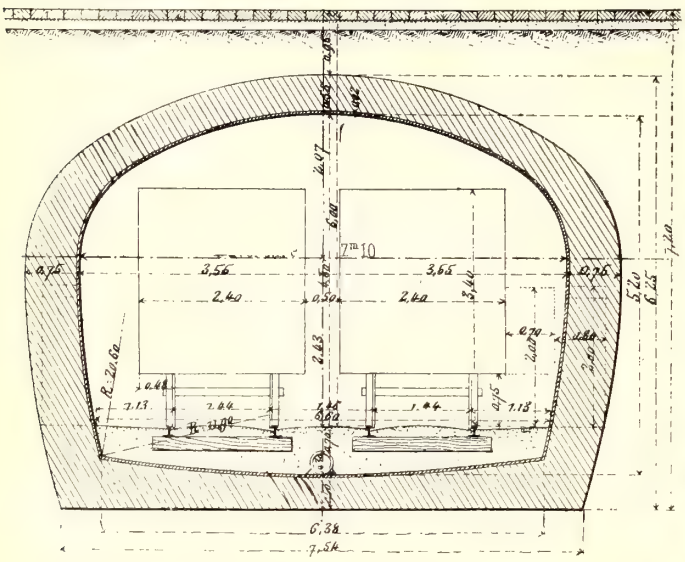


FIG 3.—SECTION OF STANDARD TUNNEL

railroad, then, from Vincennes to the Place de l'Etoile, together with the three branches to Porte Maillot, Porte Dauphine and the Trocadero, form what is called the first fraction of the underground system. It is this portion which was formally thrown open for public traffic on July 16. It was at first intended to have the opening on the 14th, which is the great national fête, corresponding to our own Fourth of July, but it was feared that the rush of people would be so great as to paralyze the road, as there would not be more than perhaps twelve trains running, and the streets of Paris are always thronged on the 14th with pleasure seekers, and immense crowds go out to the Bois de Boulogne to view the parade of the troops.

The direct connection established by the Metropolitan Railway between the main buildings of the Exposition and the far-removed annex at Vincennes should have the result of increasing the attendance at the latter place. Up to the present time there has been no means of transportation between the two divisions of the Exposition other than that afforded by circuitous street car routes or boats on the river, excepting the use of cabs, which the general public cannot afford. The boats stop at innumerable landing places, making a very slow trip, and the steamboat

FIG. 4 —VINCENNES STATION READY FOR OPERATION

companies have not considered it worth while to put on an express service, possibly because they are satisfied it would not pay.

The length of the line at present in running order is 7 miles. The construction throughout is underground, except at the Bastille, where it was necessary to cross the St. Martin Canal, necessitating an open-air stretch which includes the station. The curves at the approaches are also exceptionally sharp, there being at one side a double curve with radii of only 165 ft. At the terminal stations

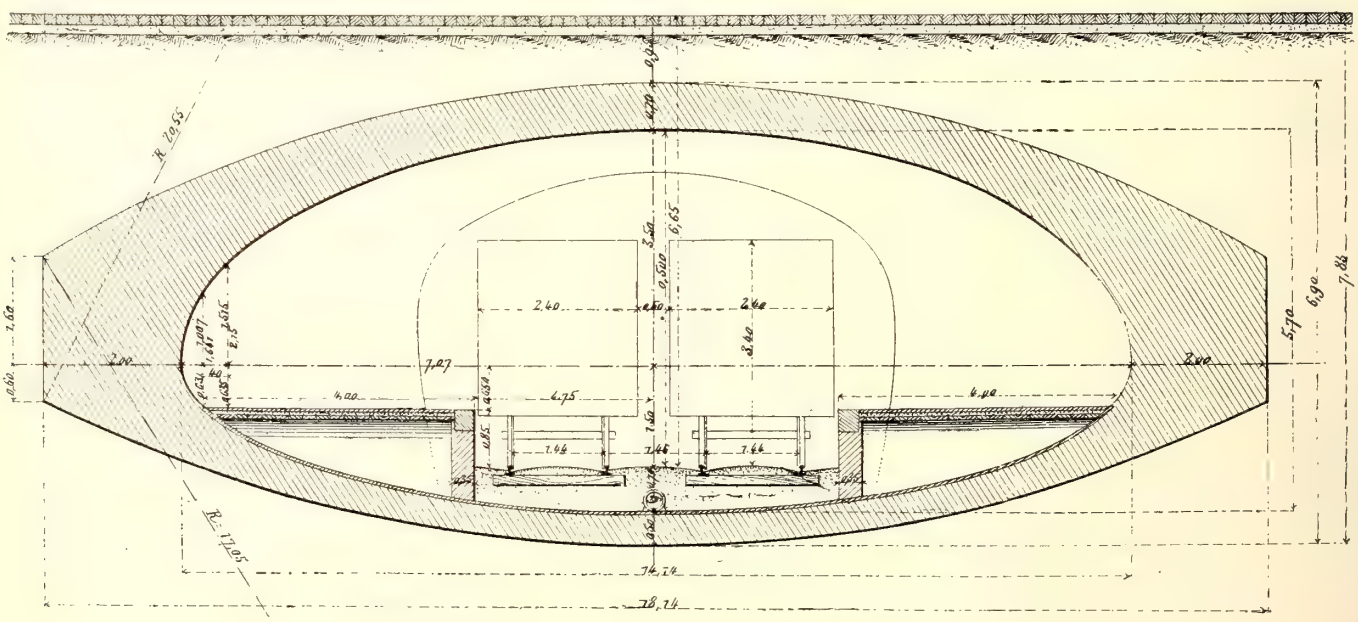


FIG. 5.—CROSS SECTION OF VAULTED STATION

the trains are brought round a loop after discharging the passengers, this arrangement allowing of rapid handling of trains, such as would not be possible in a station of the ordinary type except by the use of a considerable number of shunting tracks. Since it is not intended to transport any heavy baggage on the Metropolitan system, hardly any greater delay may be anticipated at terminal points

than at some of the important stations in the city. As a measure of precaution, however, the terminal loops are each provided with a double-track station on one side for arrivals and one on the other side for departures (Fig. 2), thus giving plenty of time for manipulation of trains. The two stations are joined by a circular section of single track laid in a narrow tunnel, the radius being uniformly 30 m, or less than 100 ft., at all the terminals. It is to be remembered, however, that the trains are hauled around these curves unloaded. On the main line, except as noted above regarding the Bastille station, the shortest radius of curve is about 250 ft. The steepest grade is 4 per cent.

The ordinary tunnel section is shown in Fig. 3, the maximum width of the straight tunnel being nearly 23 ft. 4 ins., and the height above the rails 14 ft. 9 ins. On the sharp curves the side walls are carried out further, giving additional clearance of about 7 ins., necessitated by the regulations imposed by the government, which require a minimum clearance of 27½ ins. between the car and wall at a height of 2 m above the rails. This law also fixed the maximum allowable width of car at 7 ft. 10½ ins.

On the direct line from Porte Maillot to Vincennes there are sixteen intermediate stations, and each terminal has, as we have seen, two stations entirely independent. Three different plans of construction have been adopted. The more usual form is that of a vaulted roof with a clear height above the rails of 5 m (about 16 ft. 5 ins.) (Fig. 5); but some of the stations are built with an iron roof with brick arches between the beams, and one station—that at the Bastille—is entirely open. The iron roof has been used only in cases where, in order to avoid trouble from water, it was found expedient to keep the level of the rails as high as possible, the vaulted roof requiring a greater depth On this account the low-lying stations between the Champs Elysées and the Louvre, inclusive, as well as those at the Hotel de Ville and Gare de Lyon, are built with the iron roof—a cut and cover system (Fig. 6). The general dimensions of the stations are, for the length about 246 ft., and for the width 45 ft. or 46 ft. The platforms, raised about 3 ft. from the rails, are 13 ft. wide.

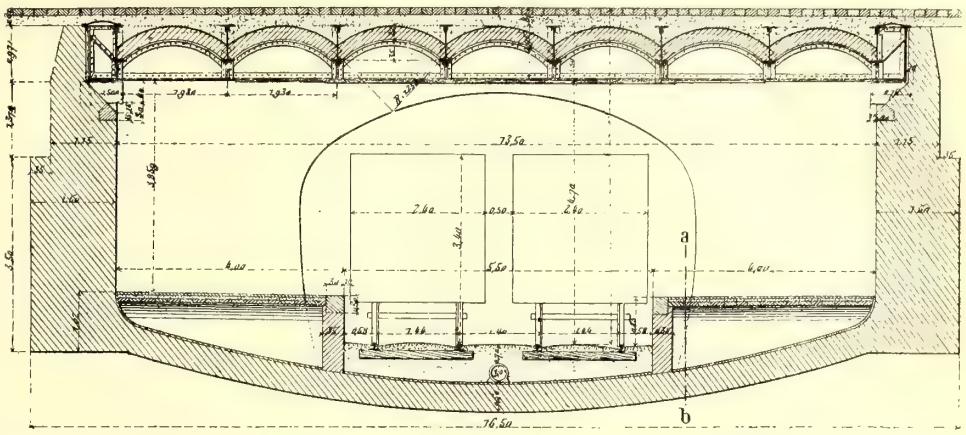


FIG. 6.—SECTION OF STATION WITH IRON ROOF

The regulations imposed by the city on the builders of the road require that no obstructions shall be placed on the streets; this means that the view across the squares or streets must not be cut off by the erection of any covered entrance to the underground stations. In consequence, the only intimation of their whereabouts is afforded by a painted board giving the name of the station, standing over the flight of stone steps, surrounded by a light railing, which lead to the passageways below. Since the depth at which the rails are laid is not more than 20 ft. to 25 ft. below the surface of the street, very little head-room is available for the building of ticket offices. Sufficient height is, however, provided for all persons, even those exceptionally tall, the lowest roof being about 6 ft. 10½ ins. At the foot of the stone stairway leading from the street is the ticket office, which may be a hall some 15 ft. square, with one side partitioned off for the ticket agents and with a counter for "gratuitous change of money." From this hall a passage conducts to the stairways communicating with the platforms, a foot-bridge being provided for crossing from one side of the station to the other. The halls and passages, as well as the more important stations, are lined with white enameled tiles, so that the rows of incandescent lamps provided for illumination are quite effective. The station of Lyon will doubtless have a large traffic from the Gare de Lyon, the terminus of the railway to the Mediterranean, which station is within a stone's throw. It will be seen that there are two platforms in the Lyon station (Fig. 8), which is built with the iron roofs supported on two rows of columns extending down the platforms, the whole interior being well illuminated by incandescent and arc lamps. The rails are laid for one double track only, which is the Porte Maillot-Vincennes line. The other platform is intended to serve the trains which will eventually run on the belt line, for it is at this point that the two lines meet, having the stations

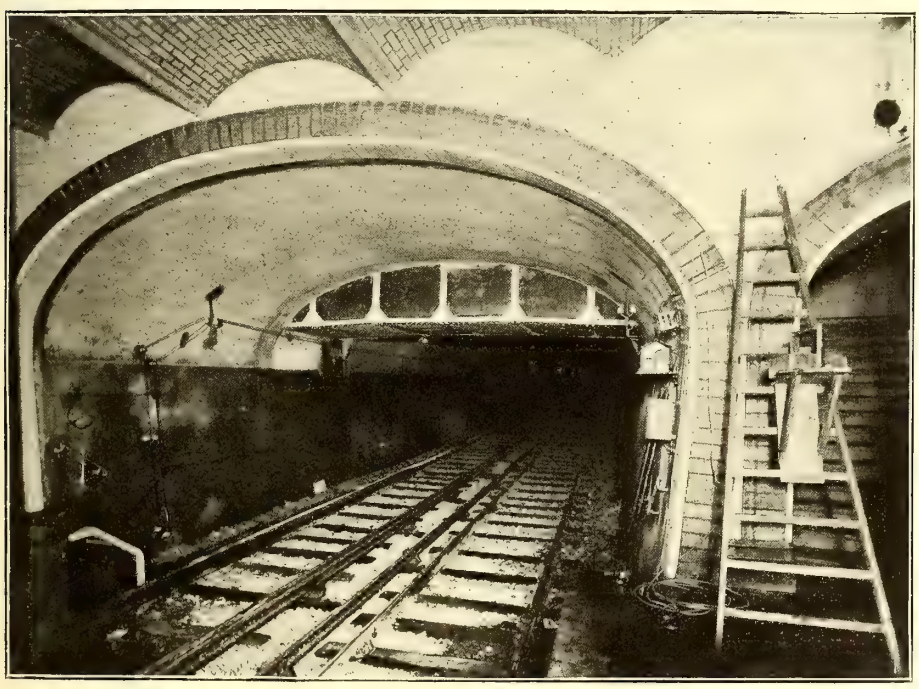


FIG. 7.—VIEW LOOKING DOWN TUNNEL FROM HOTEL DE VILLE STATION, SHOWING BLOCK SIGNAL SYSTEM

of Reuilly and Place de la Nation also in common, and separating after the latter, the belt line curving round toward the north, and the Vincennes line going east. Owing to the economy in space rendered necessary by the small amount of head-room available at some of the stations, also with a desire to avoid building long stairways to give access to the trains, the foot-bridges furnishing communication between the two sides of stations dip considerably into the tunnel cross section. In the photograph

FIG. 8.—INTERIOR OF LYON STATION

taken from the Hotel de Ville station looking down the tunnel (Fig. 7) it will be seen that the bridge is quite low, clearing the car roofs by only a small margin. This construction effectually prevents use of the railway by the

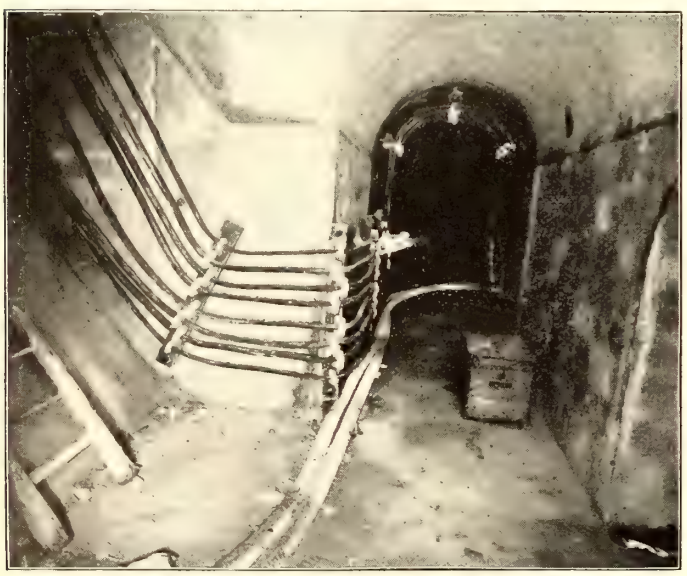


FIG. 10.—CABLE VAULTS AND GALLERIES AT PLAC DE L'ETOILE

rolling stock of the State roads, the Metropolitan cars being only about 11 ft. 2 ins. in height above the rails.

The junction of the several lines at the Place de l'Etoile has demanded a most extensive system of underground tunneling at that site, but the additional requirements of a sub-station for electric power, and large rooms for accumulators, together with elevator pits and accommodation for the necessary operating machinery and water tanks, have combined to make an elaborate honeycomb of subterranean galleries, halls and stairways, without mentioning the three immense stations. Thus the Triumphal Arch above may well be held to represent a new triumph, not of war, but of architectural and engineering skill, executed amid countless difficulties in the depths of the earth over which the stately monument is raised.

At the Etoile station one line passes beneath the others, requiring very deep excavation in order to build the lower station. For passenger service two elevators will be installed, intended principally for the lower, but available for the upper, stations. The elevator pits, solidly built with

FIG. 9.—UNDERGROUND VAULT FOR TRANSFORMERS, PLACE DE L'ETOILE

masonry walls, have a depth of 57 ft. 6 ins. As yet there is no machinery installed, the walls and passages being too damp. On the lowest story a large transformer station has been built, measuring nearly 100 ft. x 50 ft., with a high vaulted roof (Fig. 9). The row of columns down the

FIG. 11.—STATION OF VINCENNES—PORTE MAILLOT LINE AT PLACE DE L'ETOILE

center are intended to support the rails for two traveling cranes by Rondet and Schorr, of 12 tons and 6 tons capacity, respectively. The foundations shown in the illustration are intended for rotary converters and static transformers, of which three sets are now to be installed. For temporary use one of these sets is placed in a shed at the opening of the eastern elevator shaft. Both the rotary and the transformers are built by Schneider & Company, Creusot. The former is supplied on the alternating side with six collector rings, and takes current at 430 volts from

three single-phase transformers fed from an incoming 5000-volt, three-phase line, giving on the direct-current side an output of 1000 kw at 600 volts.

In order to insure the service of trains at all times and to act as a regulator to the supply, two batteries of 250 Tudor accumulators are to be installed, with a capacity of 2000 amps. each for one hour. For the reception of these batteries two double rooms have been built, one above the other, with a floor area in each of the four sections of 72 ft. x 23 ft. The floor is covered with a special acid-proof bitumen, and has a gentle slope toward one end in order that any liquids spilled may run off into a drain. The ceiling of the lower rooms is formed by beams, but that of the upper rooms is carried around in a semicircle from the floor, being, therefore, 11 ft. 6 ins. in height.

The rooms which are to receive the hydraulic plant will be 40 ft. long by about 30 ft. wide, with a height of 18 ft. Here are to be three electrically operated pumps and pressure tanks for the elevator service. Connection with the sewers from this room is obtained by means of a shaft sunk 70 ft. below the floor level. Ventilation among the different chambers of this underground installation is pro-

FIG. 13.—EXIT OF CHAMPS ELYSEES STATION, SAME DESIGN AS ENTRANCE

vided by means of galleries extending in all directions, some being used to conduct the cables from the transformer room to the railway (Fig. 10). In this engraving it will be seen that a heavily insulated cable lies on the ground, this being provided temporarily to bring in the 5000-volt current from a power station at Asnières, in the northern part of the city, at present supplying the needs of the railway. The cables held in cleats are 550-volt supply wires passing up the inclined opening on the left to the railway tunnel, where connection is made to the third rail, by which power is delivered to the motors of the trains.

Returning now to the other stations along the route, Figs. 11 and 12 show two typical views, Fig. 11 being that on the through line from Vincennes to Porte Maillot. At the ends of the platforms are the stairways leading out and the foot-bridge over the railway. On the further platform is a railing surrounding a stairway which gives access to the galleries leading to the lower station. The entrance to the stairway is on the platform of the adjoining station. This adjoining station is illustrated in Fig. 12, in which a track is shown with a line of contractor's cars used in transporting earth. A good idea is obtained of the extent of these stations, the further end being lost in darkness, notwithstanding the powerful flash light used in photographing. This Trocadero branch of the Metropolitan system has not been put in service as early as the through line, although the intention was to provide special service for the Exposition. The real value of the railway, as far

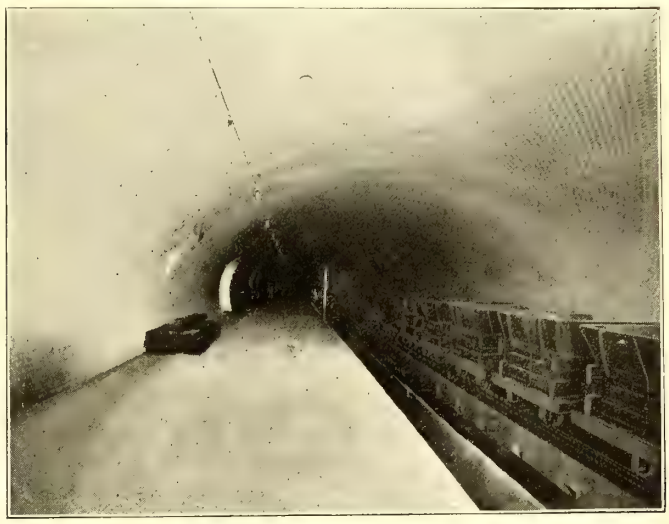


FIG. 12.—INTERIOR PLACE DE L'ETOILE STATION, TROCADERO BRANCH

as it concerns the great show, lies in the facility it has provided for visiting the annex at Vincennes, an extremely interesting section, but little known by the general public.

The first stop after leaving the Porte Maillot terminal is at the Champs Elysées station, this being one of the principal entrances to the Exposition, close to the Palaces of Fine Arts and the splendid Alexander III. bridge. The illustration (Fig. 13) shows the style of entrance and exit, no structure being allowed, other than the signboard, to stand above the street level, except when the station is outside what may be called the select part of the city, as at the Bastille and beyond. The Champs Elysées station is graced on the outside by majestic lions on pedestals, but these adornments are actually part of the architectural

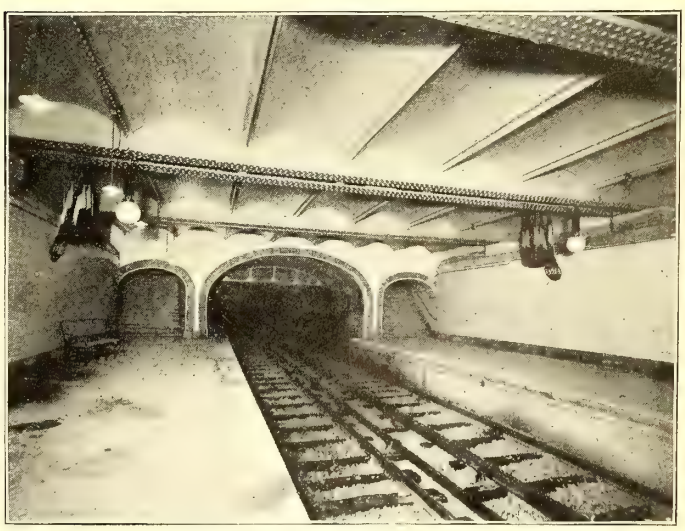


FIG. 14.—INTERIOR OF CHAMPS ELYSEES STATION, SHOWING EXITS

decoration of the Exposition gates leading to the two Palaces of Fine Arts, of which the larger one is visible in part. The interior of the Champs Elysées station may be seen in Fig. 14, which shows a decoration of French tricolor flags for the opening festival. In the distance the electric lights dotting the sides of the tunnel show the

curve of the line toward the Etoile, the absence of smoke allowing a clear view along the track. For the illumination of the station both arc and incandescent lamps are used, the current being taken from the power supply mains. The ticket office of this station is of the same type as those used throughout. Entrance is obtained by stone steps open to the sky, and the traveler is confronted with a notice requesting him before purchasing a ticket to get change at the bookstall, the agent being obliged to give his services in that regard free of charge. The tickets are of the ordinary size, made of pasteboard. Return tickets are issued for second-class only and are not available on the outward half after 9 a. m. The cost for single tickets is 5 cents a trip first class, 3 cents a trip second-class, and 4 cents return second class. The company operating the road under lease from the city (who builds it) does not appropriate all of this amount taken in, however, small as the fares are, but, in order to cover the interest on the city debt and other obligations, the company is required to pay 1 cent on every 3-cent or 4-cent fare and 2 cents on every 5-cent fare received, as well as a tax on the number of passengers carried beyond a total of 140,000,000 in one year.

FIG. 15.—VIEW IN TUNNEL PORTE MAILLOT—VINCENNES LINE

FIG. 19.—ENTRANCE TO BASTILLE STATION

FIG. 16.—TRAIN IN HOTEL DE VILLE STATION

A view down the tunnel from this station (Fig. 15) shows well the general construction. For the track Vignole T-rails are used nearly 50 ft. long, weighing 106 lbs. per yard, and for the conductor a third rail, double headed, weighing nearly 79 lbs. The track rails are laid on metal ties 7 ft. 2½ ins. in length, spaced about 36 ins. between centers; every third or fourth tie is 6 ins. longer on the inner end, and carries the insulator for the third rail, which consists in a cast iron chair supported on two iron pins fitted to an iron base insulated by wood and protected by overhanging flanges on the chair.

The Hotel de Ville station is one of the most important, being situated within the busiest portion of the city. Fig. 16 shows a train in this station and on the platform some of the railway company's engineers. The ordinary train is composed of one motor car and two trailers, but three trailers are used when the traffic becomes heavy. The cars, to which reference will be made later, are first and second-class, and combination first and second; all the motor cars are second-class. The trains are run at intervals of a few minutes, and Dardaud's electric block system is about to be put into service, operating automatically. The signal is on the tunnel face, as seen in Fig. 7, and the wires leading to the further connections are clearly shown in the previous figures.

The Lyon station (Fig. 17), already mentioned, is likely to have extensive patronage. A desire on the part of the railway company to avoid accidents during rush hours has probably prompted the posting of the notice, "Attention aux 3 marches!"—"Look out for the three steps!"—which greets incoming passengers from the bright light of the street, who otherwise might fall in their hurry to reach the train. From the platform below there may be seen (Fig. 18) at the western end of the station a blank wall having the appearance of a tunnel bricked up and plastered alongside of the actual tunnel through which trains are continually passing. This is where the belt line will join the present line at some future day, and, making use of the same tracks for a distance of about a mile, will leave again at the station of Place de la Nation to continue a northerly course. The Lyon station has two sets of double tracks, one for each division.

The Bastille station, being of necessity built over the canal, is more in evidence than any other part of the railway system. The entrance is from the square, and the bridge over the tracks is on this level, together with the ticket office. It is a pleasing contrast to find a stopping place above the surface of the ground, and the station is decidedly airy and bright. We have already spoken of the

sharp curves rendered necessary at this point, and the photograph taken along the platform (Fig. 20) shows the bend of the tracks as they enter the tunnel. The rails also show distinctly in the bright light. It will be observed that the joints are not opposite, nor do they alternate with regularity, but they are placed nearly opposite each other. Long copper bonds ½ in. in diameter unite the track rails, passing over the fish-plates; the third rail has short, flat bonds.

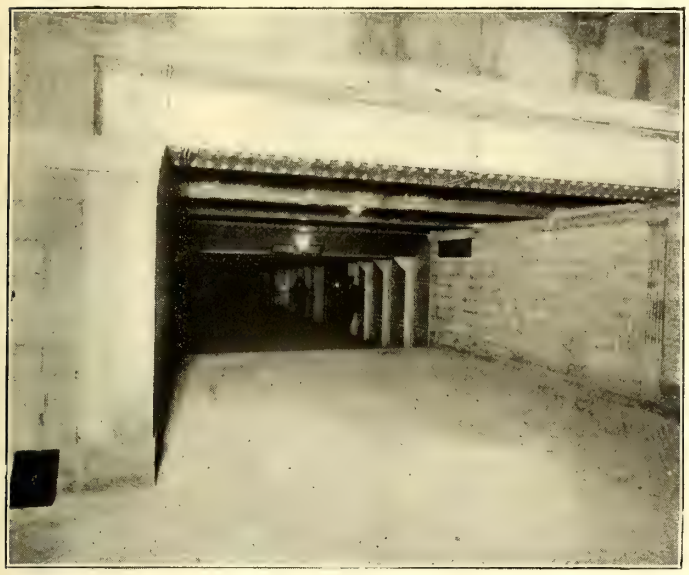


FIG. 17.—ENTRANCE TO LYON STATION

FIG. 18.—TUNNEL AT LYON STATION

The photograph of the Vincennes station (Fig. 4) is taken on the departure platform. It will be remembered that a separate station is built to receive incoming trains, two tracks being used in each case, one on either side of the platform, and the two stations are identical in design. Beyond the stairway the two tracks join and pass by way of a narrow tunnel to the other station. The platforms are of sufficient length to permit of two trains standing on each side, thus allowing of convenient storage. At this end of the line, however, there has been provided a car house, to which a branch line is run from the loop between the stations. The accompanying engraving (Fig. 21) shows the building in course of construction, and the yard outside, which will be laid with tracks, accommodating 150 motor cars and trailers for the present. The first order for motor cars called for forty-six, and at the time of starting the road there were twenty-two delivered, twelve being furnished with controllers at each end, so that they may be run in either direction, and ten having a single controller. The single-controller cars are intended for use on those sections of the road where loops are used at the terminal stations, as there is then no necessity to provide for running backward, and the double-controller cars may be used when switching is resorted to for changing the direction of travel.

One of the double-controller motor cars is shown in Fig. 22 standing in the yard of the car house. A steep incline communicates with the Ceinture Railroad above, where some car bodies may be seen on the freight cars ready for unloading. The motor cars, 29 ft. 6 ins. in length, are furnished by the Ateliers de Construction du Nord de la France, whose factories are at Blanc-Misseron (Nord). Double frames are provided, one to support the car body and one for the truck, this design allowing the removal of the upper portion without interfering with the lower. The trailers, however, supplied by the Franco-Belgian Company, of Raismes, have but one frame, painted black, while the upper frame of the motor cars is painted red, in order to make them more readily distinguished by train

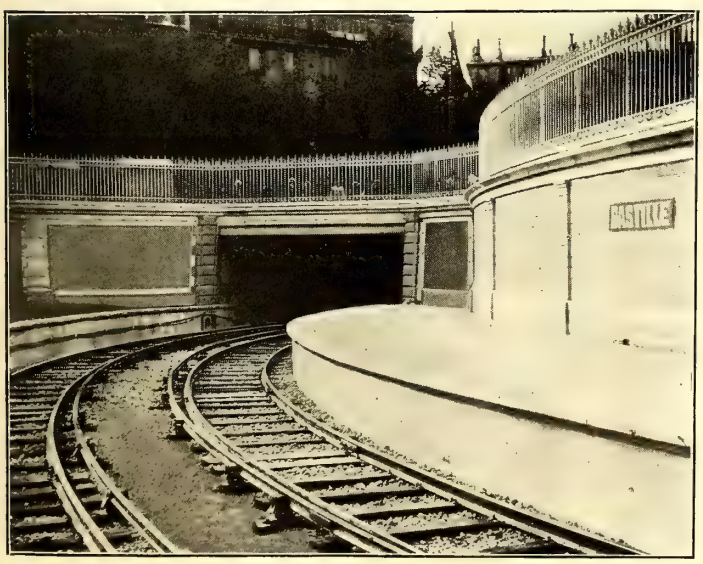


FIG. 20.—BASTILLE STATION, SHOWING THIRD RAIL

FIG. 21.—INTERIOR OF VINCENNES CAR HOUSE

hands and perhaps to give some brightness to the front of the train. Both these car factories are close to Valenciennes, in the Department Nord of France. The car

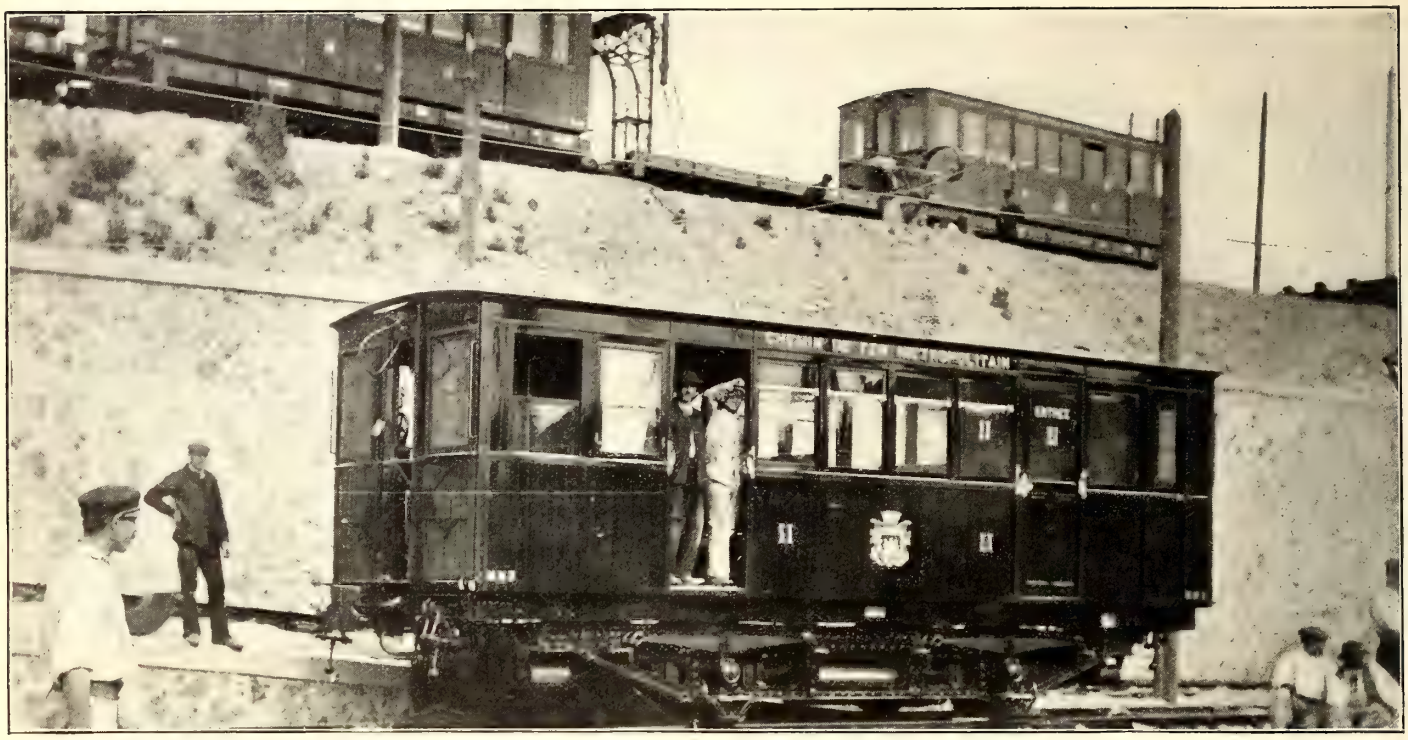


FIG. 22.—DOUBLE CONTROLLER MOTOR CAR

wheels are of forged steel, made by Baume & Marpent, and have a diameter of nearly 33½ ins.

The Metropolitan Railway Company is to be congratulated on its choice of motors, as there is no doubt that its selection of Westinghouse material in this respect has eliminated from the railway system all possibility of breakdowns, besides providing thoroughly reliable and substantial apparatus whose value will be more appreciated as repair bills are found to be low. In some other directions the railway company is perhaps not so fortunate, but is possibly desirous of assisting home enterprise.

The motors supplied by the Westinghouse Company are of 110-hp type, No. 70, two motors being provided for each motor car. In a short compartment at the end of the car is the fine large controller, of the new standard 98-A. type. In the roof above is an automatic circuit breaker, car type, and on the other side, against the partition, a toggle-joint fuse box carrying a copper wire fuse which is replaceable in a moment if burned out, and which may be easily removed if it is desired to open the circuit to prevent tampering. A Wurts lightning arrester is placed alongside the fuse box, of the ordinary form for cars.

All the above apparatus is by Westinghouse, but the air brakes are of French make. They are made by Soulerin, of Paris, and air compressors and motors are furnished by Amelin & Renaud, also of Paris. These motors, of the spherical ironclad type, are connected by gears to the compressor, which has two cylinders 90 degs. apart, and supplies air to a reservoir in which the pressure is kept at about 65 lbs. per square inch. The output of this motor is only 1½ hp, which is rather low.

Contact to the third rail is obtained by means of two shoes of the ordinary double-link form. In the car depot an overhead construction is used, and it will be observed that two wires are used, on which a four-wheeled carriage runs, passing through the loop-shaped supports. A cable from this carriage is fitted with a plug, which may be pressed into a socket on the motor car, providing by this means a connection to the controller and motors.

The motor cars are lighted by eight lamps of 16 cp, and two lamps on the outside of the cars at the head of the train. Also in the small vestibules at the end there are lamps which may be switched in, instead of one of the interior lamps. The trailers also carry ten lamps.

The start of the line was made with twelve trains of three cars each; one motor car, one first and second-class combined, and one second-class. The motor cars are all second-class, and carry twenty-eight passengers, seats being provided for twenty. The seats are back to back, some accommodating two persons, or three, and some being narrow seats for one person only. Plenty of room is provided in the middle of the car, with the object, it is

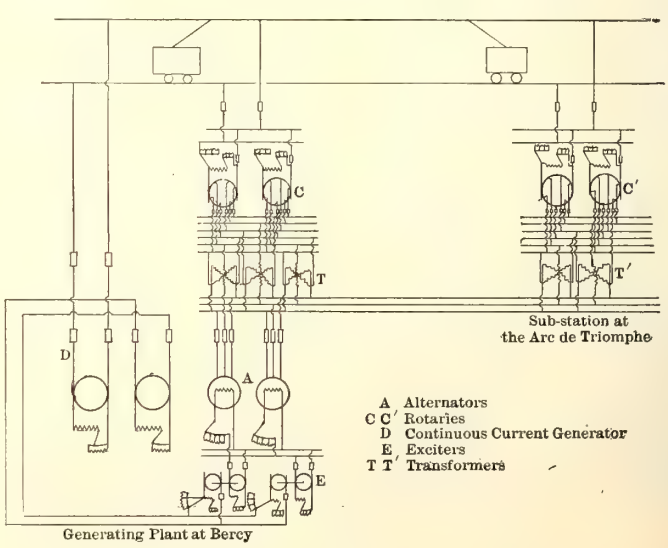


FIG. 23.—SCHEME OF ELECTRICAL DISTRIBUTION

said, of facilitating circulation. It has been said that only twenty to twenty-five seconds will be allowed for stops at stations, but, while this may seem a very short time to the French mind, it is about double the time usually required

on the London Underground Road, except on occasions of heavy traffic.

The power station which is to supply current for the Metropolitan Railway is in course of construction. The site is near the Lyon station on the banks of the Seine at Quai de la Rappé. The equipment of this station will include three batteries of six boilers each; one 1500-kw direct-current, 600-volt engine and generator; three 1500-kw three-phase, direct-connected engines and alternators delivering current at 5000 volts and 25 cycles, and rotaries, exciters, storage batteries, etc. Under ordinary circumstances the direct-current set will be used to supply the line in the immediate neighborhood of the station, but, if necessary, power can be taken from the alternating-current board. At present there are only two sub-stations. The scheme of distribution is shown in Fig. 23. The boilers at the main station are of the semi-tubular type, and will supply steam at 142 lbs. per sq. in. The engines are vertical, compound, condensing, though capable of working with free exhaust, and are fitted with Corliss valve gear. Their cylinder dimensions are 1800 mm and 1100 mm x 1500-mm stroke (70.9 ins. and 43.3 ins. x 59 ins.); each engine is fitted with a fly-wheel weighing 63,000 kg (138,600 lbs.), and operates at 70 r. p. m. The rotaries at the sub-stations are of 750 kw capacity each. A section and plan of the main station are given in Figs. 24 and 25. Fig.

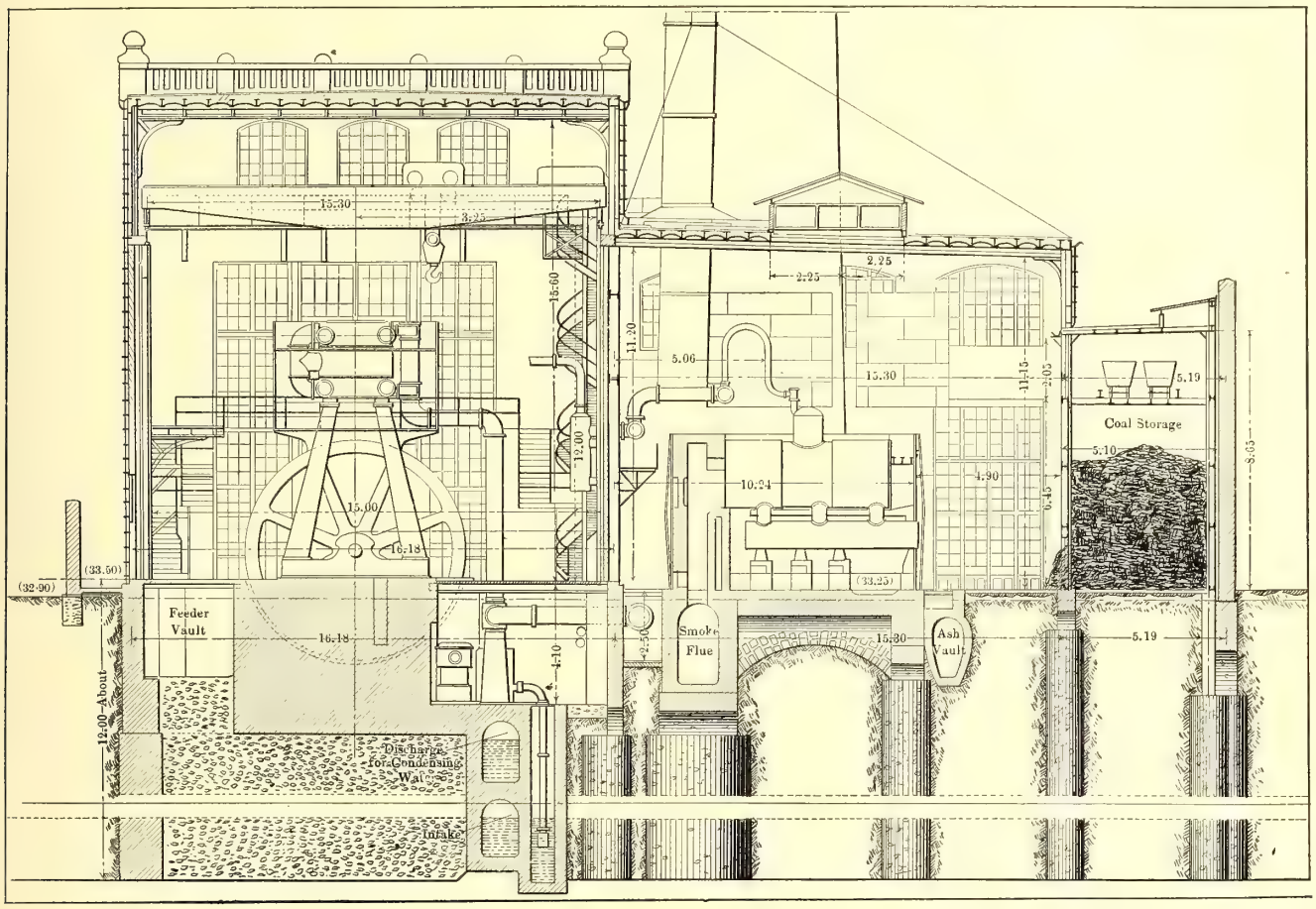


FIG. 24.—TRANSVERSE SECTION OF POWER HOUSE

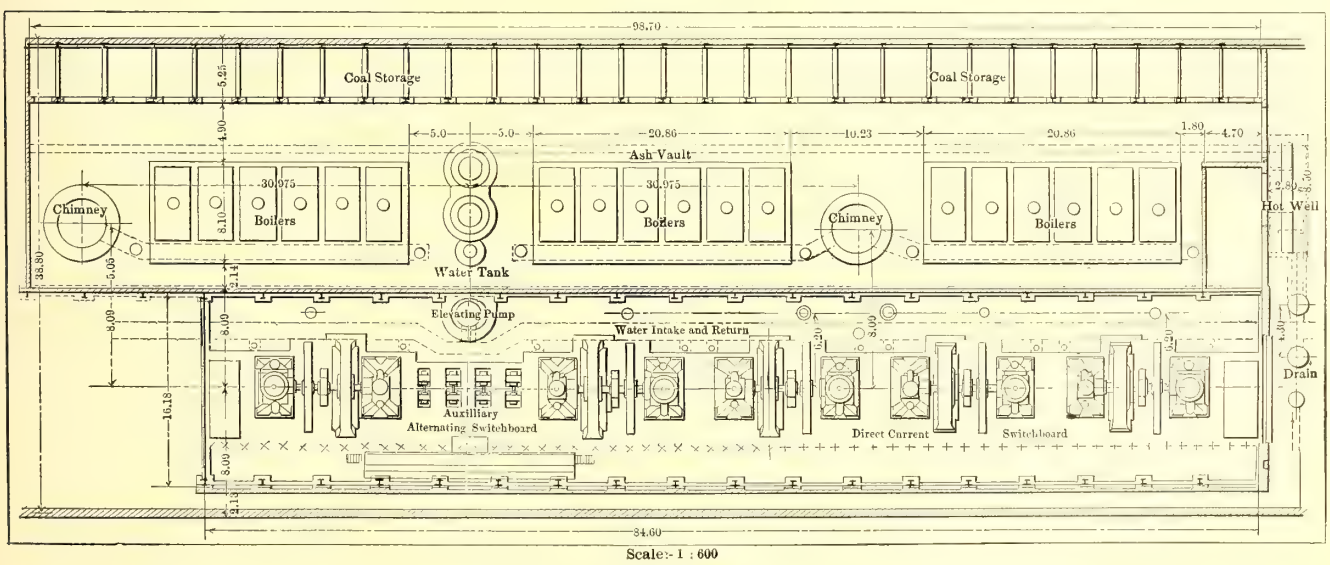


FIG. 25.—PLAN OF POWER HOUSE

26 shows the exterior of the station. The whole station outfit is to be provided by Schneider & Company, of Creusot.

One of the chief reasons that the Parisians in general were not aware of the extent of the subterranean work going on was that so little surface activity was visible. The reason for this was that arrangements were made for transporting the excavated earth by tunnels to the river. Four such tunnels were built, one at the Avenue d'Antin, above the Champs Elysées station, another at the

FIG. 26.—EXTERIOR VIEW OF THE POWER HOUSE

Place de la Concorde, another at the Louvre station, and another close to the Hotel de Ville station. By this means the streets were kept clear of an endless succession of carts loaded with earth, and the process of excavation could be pushed more rapidly to completion. This comprised the sections between the St. Paul station and the Champs Elysées. Near the Bastille the earth was removed by canal-boats, for the remaining sections of the line convenient points were selected, from which loaded carts could be sent to the river without seriously interfering with regular street traffic. Such points were at the terminal stations of Porte Dauphine and Porte Maillot, the Place de l'Etoile, Gare de Lyon and Place de la Nation. Nevertheless, as soon as the tunnels could be laid with rails a great part of the transportation of excavated earth was directed to the special tunnels, even from a distance.

The engineer in charge of rolling material and electrical equipment for the Metropolitan Railway Company is Henri de Grièges, who has seen a great deal of American practice in extended visits through the United States. The general director of the company is Mr. Maréchal.

The Westinghouse Company has a capable and experienced engineer in Philip Salberg, who has been superintending the setting up and operation of the material furnished by them. Mr. Cocquillot, road foreman of electrical equipment for the Metropolitan Company, has contributed largely to the initial success of the undertaking by careful and conscientious work in the important position which he has filled.

Electric Railway Possibilities in the Philippines

BY G. D. RICE

Better transportation facilities in the form of electric lines are urgently required in the first and second class cities of the Philippine Archipelago. The writer has visited most of these cities and has talked with the leading merchants of Manila and Iloilo and other cities, and the universal opinion is that such lines will pay well. American enterprise and push are securing a hold, and the largest towns, especially the two cities mentioned, are rapidly becoming Americanized. Nearly all other cities in the Orient, many of them smaller than these two cities, have already street railway lines in successful operation, and new ones are being built, and it will only be a question of time when the electric car will be as familiar a sight in the principal cities of the Philippine Islands as it is in the United States.

The conditions in the cities mentioned in these islands have greatly changed during the last few months. New business houses have opened in large numbers in the outskirts of the cities, while many private residences have been erected by persons who have been driven in from the interior by the recent wars of the guerilla bands. The territory covered by Manila and Iloilo, which, like other Oriental towns, is very large, has become greater than ever before, and the indications are that the expansion will be greatly increased before the close of the present year, for there are many contracting firms at work putting up business houses, factories and private dwellings. At the present time the working classes are obliged to walk or hire carremettas or bull cars, and as most of the workers get only about 20 cents a day, it will be seen that they cannot afford to hire expensive traveling outfits. The only street car line in Manila now is operated by animal power, the stunted native horse being employed. Only a few cars are run, and these at long intervals. These cars, however, are filled to the point of overflowing by the natives, so there is no chance for the ordinary traveler to get on. The road need not be considered as a factor in the traffic of the city, although it might be used as a basis upon which to establish a modern form of railway line. In Iloilo there is no street car line, but instead there are lines of busses and carremettas. These do a good business, but cannot begin to accommodate the people who desire to travel.

Owing to the fact that most of the streets in Manila are very narrow, special plans in the establishment of an electric system would have to be adopted. There are a few main thoroughfares which are broad enough for all practical purposes, but such streets are few compared with the narrow ones. These narrow streets are going to interfere with the improvement of the cities of the Philippines for many years, and possibly until the streets are widened by tearing out alternate blocks. Only the shortest cars can be employed in these narrow streets, and probably a narrow gage would have to be adopted, as in many of the European cities. The sidewalks are also narrow, and in many cases the span wires will have to be attached to the buildings on each side of the streets. In Iloilo a standard gage road can be used, and the suburbs of Manila are also suitable for standard gage tracks. The streets in both cities are crowded not only with vehicles, but with pedestrians, who walk in the streets. This would interfere to a considerable extent with the speed attainable, but it seems to be the general opinion that if an electric line were built much of this traffic would be diverted to it, and that the effect would be to reduce considerably the street congestion.

An advantageous condition for the construction of lines in these islands is the fact that stone for ballast can be secured very cheaply. There is found here in the mountainous sections of Luzon and Panay vast quantities of so-called sandstone, which not only makes a good ballast, but is an excellent building stone. Many of the churches and bridges in the islands have been constructed of this stone, and it has been found very desirable. Taken altogether the outlook for electric traction in the Philippines is exceedingly good.

The First Five Years' Experience in Maintaining the Niagara Gorge Railroad

BY GEORGE A. RICKER

Some æsthetic souls, whose observations concerning Niagara Falls Mr. Slicer has compiled in "The Niagara Book," doubtless held up their hands in horror at the mere suggestion of building a railroad in the Gorge of the Niagara, but I do not believe they can harbor resentment against us, for the tracks hugging the shelf at the foot of the great cliffs and winding their way beside the waters look for all the world like toy tracks that embryo engineers in their childhood build, with cars running slowly up and down, seeming no larger than the plaything trains they used to wind and watch with breathless interest in their perilous career across the floor. These good people failed to appreciate the depth of the canyon, and rightly feared the destruction of its beauty. It was indeed inevitable that the appearance of the Gorge should, for a time, suffer by the operations of building, as displacing the foot of the slope in excavating for the roadbed meant that its equilibrium would be disturbed, that slides would take place and carry with them some of the vegetation which covered the talus. A year or two sufficed to re-cover these bare spots with shrubs and vines, that, growing in such luxuriance, when viewed from the highlands above seem like landscape gardens, blending with their varied foliage the deep tranquil blue of the skies with the snowy white and brilliant greens of the rapids below. All lovers of Niagara, and surely those who entertain feelings of special admiration for the Whirlpool Rapids, must, it seems to me, take pleasure in the keen delight of the eager throngs that view the splendid panorama of the Gorge from the vantage ground of the new road. Before the railroad was built but little could really be seen of this wondrous spectacle. At a few points only visitors could get narrow glimpses of the tumbling waters, from stairways and crevices in the cliffs; now the whole river from the Falls to the silent depths at Lewiston can be seen and enjoyed.

While it is not known who first conceived the idea of building the railroad in the Gorge, it is certain that two well known Buffalo men, Benjamin Fenton and Ensign Bennett, were the first to actually undertake the difficult work. It was their intention to build a road from the Maid of the Mist Landing in Prospect Park to the Whirlpool, with narrow-gage tracks, to be operated by steam, for it must be borne in mind that even so recently as 1886 an electric railroad was not practicable. The opposition met by these gentlemen from vested interests was so great that they finally abandoned the work.

In 1889 another prominent Buffalonian, Captain J. M. Brinker, purchased the franchise of the Whirlpool Company, and reorganized the enterprise under the name of The Niagara Falls & Lewiston Railroad Company. The line was continued beyond the Whirlpool through the Gorge to the village of Lewiston, where connection was made with the New York Central Railroad and with the steamers for Toronto. At the Niagara Falls end of the line the location was changed to ascend the talus, and by climbing the high bank the city of Niagara Falls was reached, where connection was had with the other railroads reaching that point. The courts sustained the new company, as they had failed to do the Whirlpool Company, granting to it the right of eminent domain. From this time rapid progress was made in securing the necessary right of way, either by purchase or by condemnation.

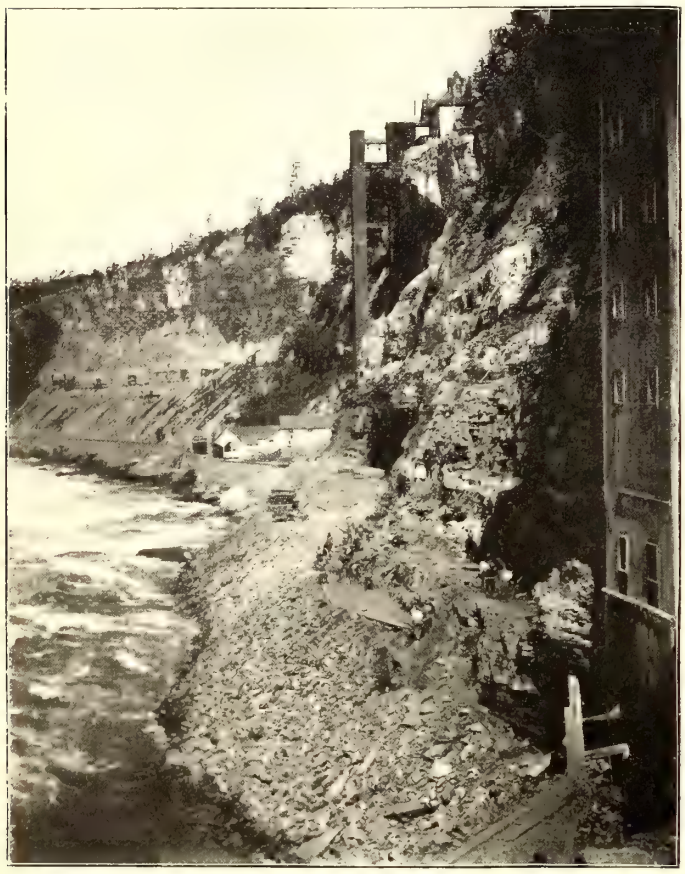
Probably no more difficult railroad survey was ever attempted than this. The slopes, which from the uplands seem to be covered with soft verdure, and to present no great obstacles to progress, were found to be at close range almost impenetrable jungles of underbrush. Shrubs and trees in countless varieties were intertwined and bound together by the wild grape vines, grown to such density and strength as only the wild grape can, when undisturbed for many years. Much trouble was experienced in the insecure footing, as nicely balanced rocks of great size would roll down the slopes, crushing everything before, from the weight of a man climbing over them. The work of the survey was hazardous in the extreme, for not only was the vegetation dense and the footing insecure on the talus, but for a distance of about one-half mile below the railroad bridges, nearly vertical cliffs extended from the Highlands to the rapids below. At several points in this section men from the engineer corps were lowered over the cliffs and flags placed on projecting ledges where they might be seen from the top of the bank on the Canadian side. Base lines were established on Canada's side of the river, from which the flags were located by triangulation. Beyond this section, and continuing to Lewiston, the line was run following the curving bank of the river, and as nearly as possible 20 ft. above the average water level. Just before undertaking this survey I had returned from railroad location in the Rocky Mountains, and was imbued with the idea

BEGINNING WORK ON TALUS NEAR LEWISTON

that nothing in this part of the world could equal the difficulties I had met in the canyons of the Rockies. After locating the Gorge road my views have been substantially modified, for, although the cliffs of the Western canyons exceed many times in height the walls of the Niagara, nowhere are there to be met the difficulties inseparable from the tremendous forces working in the Niagara rapids.

Construction of the road was begun on April 11, 1895, by Crage & Tench, contractors, of Buffalo, who furnished men and tools and their services, for 10 per cent of the force account. Beyond a profile, which it was found impracticable to follow, no detailed plans had been made since the survey. The method adopted in building was aptly described by one of my rodmen, when he said, "It was by main strength and awkwardness." My orders were to build a railroad in this unpromising place, and I proceeded forthwith to obey. Had classification been attempted, two kinds of material would have been named: loose and solid rocks, as the talus is made up of large and small stones with not enough earth to fill the interstices, and no cementing material, although the roots of dense vegetation helped to hold in place and maintain a much steeper slope than would otherwise have been possible. The deep channel of the river afforded the very best place for wasting the material excavated, and work proceeded rapidly. From 600 to 1000 men were employed, and the

first 5 miles roughly completed; one track laid, and the work train reached the southern terminus Aug. 25 of the same year. On the inner side of the roadbed a slope was formed that would stand for the time being, which meant that heavy rains and the frost in the coming spring would bring down large quantities of material left on the steps above. Crossovers were placed at such point as seemed to threaten, and from time to time as slides occurred the road was operated with single track in section, and large numbers of men quickly removed the encroaching talus.



THE OLD BUTTERY ELEVATORS AND CLIFFS WHERE VERTICAL ROCK CUT OF 100 FT. WAS MADE. LOOSE ROCK, SHOWN BY SLOPE, WASHED AWAY NOW

Several large slides took place in the early part of 1896 and again in 1897, but the quantity decreased each year until the spring of 1899, when but trifling amounts of earth and stone were found after the frost had come out of the ground, indicating that a condition of stable equilibrium had been reached. The slopes are now fully covered again with vegetation, and have taken on their former appearance of stability and beauty. Many culverts were necessary in this lower section of the road, but fortunately few bridges were required. Near the village of Lewiston a small stream in a deep gully, running into the river from the foot of the Lewiston escarpment, is crossed by a timber trestle 124 ft. in length, and 42 ft. high. Two miles further up the line is a 70-ft. decked span latticed girder over a gully, formed by another lateral stream, into which for years the New York Central Railroad, which is located about 150 ft. above us, has wasted its surplus earth and rock. These two bridges are the only structures in the lower 5 miles of the road, and the wooden trestle will be replaced in the coming winter by a steel viaduct. The latticed girder bridge put in last summer replaced the earlier wooden structure. The tracks for the entire length of the road are ballasted with rock borrowed from the talus; no crushing was necessary, as in many places clear slides of small stone, not much larger than ordinary broken stone ballast, was found, furnishing an almost unlimited supply of excellent ballast. The ties are of cedar, except on the steep grades, where oak was used, and all are of the standard steam railroad sizes and spacing. The rails were rolled by the Carnegie Steel Company, weigh 60 lbs. to the yard, and are of the "American Society" section, No. 110. No attempt was made at mathematical alignment, as the roadbed followed the irregular outline of the natural slope. None of the curves is at all sharp for the slow rate of speed required by the schedule, and all that are less than

ONGIARA POINT, VIEW TAKEN DURING SURVEY

300 ft. radius are protected with guard rails. A timber guard extends the entire length of the road outside of the outer rail.

Construction of the upper section of this railroad, beside the rapids and to the top of the high bank in Niagara Falls, was much more difficult and tedious. South of the old Buttery Elevator, at the terminus of the first year's work, began almost vertical cliffs, extending from the top of the escarpment to the seething rapids below. Drills and men were lowered over the cliffs to the first ledge, about 100 ft. above the grade line, and blasting operations carried on mostly by hand. The blasts were fired usually at noon, when hugh quantities of rock were thrown into

ONGIARA POINT, VIEW TAKEN AFTER COMPLETION OF ROAD

the river, disappearing beneath the tumbling waters of the rapids, without seeming in any way to obstruct the stream or to change in the slightest degree the curve of the waves. The vertical cutting averaged nearly 100 ft., and estimated roughly, 100,000 cubic yards of rock were thrown into the river from this one-half mile of line. At the site of the old Van Horn elevator, about one-fourth of a mile below the railroad bridges, in a deep recess in the cliff, an attempt was made to construct the roadbed in the swift current of the rapids. This experiment I believed would be futile, as a powerful stream of water was constantly discharged

upon the new embankment, diverted from the main current by a large boulder, about 50 ft. from the cliff. It was evident that this bed had been excavated by the same powerful agency, and it was but waste of time and money to attempt to place in its way any structure less substantial than the cliff, which it had cut out. I speak in some detail on this point, as it has since proved to be one of the most difficult parts of the roadbed to maintain. During a period of high water in the spring of 1897, when the river rose 19 ft.

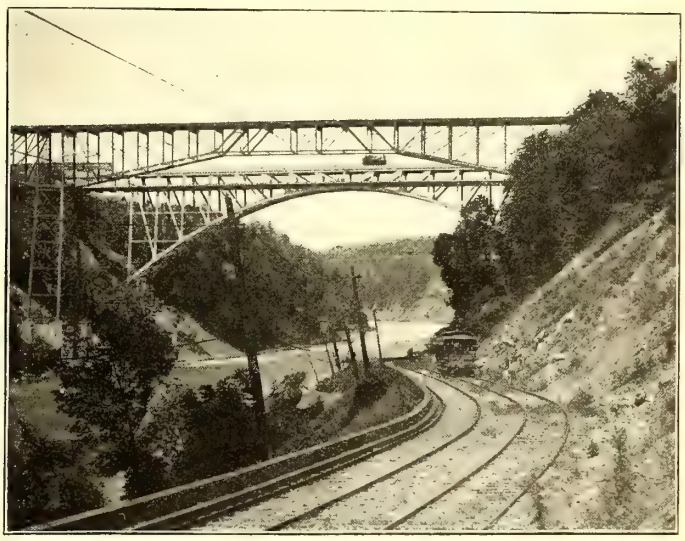
GIANT ROCK ON LEFT, DEVIL'S HOLE RAPIDS ON RIGHT. VIEW TAKEN DURING CONSTRUCTION

ALMOST VERTICAL CLIFFS, MOST DIFFICULT PART OF SURVEY. VIEW TAKEN JULY, 1886

above its ordinary level, some of this embankment was carried away. A substantial crib of large timber, which replaced the embankment, was in turn washed out in 1898, after which the company determined to do what it might profitably have done at first, and the cliff was blasted away and a shelf made of sufficient width for a single track.

During the early part of the summer of 1899 the old Niagara Falls & Lewiston Railroad Company became seriously embarrassed, and its property passed into the hands

THE LONG GRADE. FALLS IN THE DISTANCE. VIEW TAKEN AUGUST, 1899



FINISHED ROAD, CANTILEVER AND NEW STEEL ARCH BRIDGE VIEW TAKEN AUGUST, 1899

of a new corporation, at the head of which, as president, is General Francis V. Greene, of New York, and as vice-president, Herbert P. Bissell, of Buffalo. These gentlemen and their associates, after thoroughly reorganizing the enterprise and placing it upon the most substantial financial basis, proceeded to the practical reconstruction of the entire road. Operation in 1899 was not begun until July, when most of the work was finished. The talus having, as I have already said, been reduced to a condition of stability, the greater part of the work consisted in protecting the embankment from erosion by the rapids. The general method followed is best described as "enrockment." This consists in riprapping or paving the slopes with very large stones. To accomplish this a specially constructed flat car, carrying an electric derrick, was built, and has been in constant use for several months. Two men operate this car, and as many additional as are necessary assist in taking out the stone and replacing them in strengthening the embankment. Long stretches of the outer slope have been thus protected, and this work will proceed until all exposed surfaces will be entirely covered in the manner described. At the bay referred to, where the original embankment was washed away, the river from the ledge or shelf on which the inner track rests as before described, has been filled with large stones out to the great boulder of Niagara limestone, and these stones are so arranged on the outer side as to present the appearance of being carefully paved. Protection for the second track has thus been provided, and the substantial character of this enrockment is such as to resist for all time, in my opinion, erosive action of the waters. Beneath the cantilever steel arch bridge the tracks are gauntleted, passing over two latticed girder spans in front of the bridge piers. The total width between the faces of the cantilever footings and the deep waters of the river was but 13 ft., and a single track was therefore unavoidable. This is the only point upon the line where the road is so contracted and operation is carefully guarded by stopping approaching cars by the use of suitable signals, and a watchman constantly on duty.

From the bridges to the top of the high cliff, a distance

of nearly a mile, the average gradient is 4.7 per cent, the maximum 6.4 per cent, and the total elevation overcome is just 200 ft. Continuing beneath the New York Central's five tracks the line sweeps sharply to the right on a curve of 50 ft. radius, the sharpest on the line, and from thence parallels the Central for a few hundred feet, reaching Second Street in Niagara Falls, where connection is made with the tracks of the Niagara Falls Street Railway. The views herewith show stages in the progress of the work, and were taken by Mr. Arnold.

Operation of the Niagara Gorge Railway is continued from the first of May of each year to the first of March of the following year. March and April, I may state positively, are the only months when the loose material from the cliffs falls upon the slopes of the talus. This is, of course, when the frost is coming out, and small stones which have been wedged out by the ice are loosened. Since beginning operation of the road in 1895 to the present time, no passenger or employee has ever received injury from falling rocks. I was daily over the road during its construction, and have many times since passed from the Falls to Lewiston and return on cars or on foot, and have never seen a rock fall. It is my opinion that with due care, and such is most certainly maintained by the present management, the maintenance of this railroad need not be excessively expensive, and that the same safety of operation can be obtained as is secured on any mountain railroad.

Since the acquisition of the railroad at the top of the bank on the Canadian side by the International Traction Company and the reconstruction of the Suspension Bridge at Lewiston, a belt line has been in operation, over which cars of the Niagara Gorge Railroad Company pass, starting from Niagara Falls, and going to Lewiston by both railroads, making the trip down the Canadian side across the Suspension Bridge and up the Gorge; and also in the reverse direction. The extraordinary beauty of the scenery from the commanding heights on her Majesty's side of the river, combined with the grandeur and wondrous effects of the rapids, which Hawthorne describes as "an impetuous river of snow," affords to the traveler an experience which is at once unique and impressive beyond power of words to describe. The river is itself so fascinating that I am loath to leave it for other scenes, but that the public appreciates the belt line is shown by its generous patronage.

The report of the passenger department of the Gorge route for the month of July, just passed, shows an increase of 35 per cent in passengers carried over the corresponding month in 1899 and this, in spite of the recognized fact that this year at Niagara Falls has been so far a dull one. The managers of all other attractions complain of the scarcity of people at the Falls this year, but the Gorge route is prosperous, and its management well satisfied with the showing of the road.

A new feature has been added to the attractions of the Gorge by illumination of the rapids at night. Trains are made up at the Falls, and run to the rapids, where an hour or more can be spent in contemplation of the beautiful spectacle, the lamps are hidden from view, and their rays projected over the waves by reflectors, so arranged that the illumination is most effective. In addition to the arcs, a large searchlight, mounted on a flat car, takes position some distance below the observation platforms, while its powerful beams are thrown against the waters and screens of green and yellow interposed, producing most beautiful effects. The roar of the waters against the walls of the Gorge, the depth of the canyon in the darkness of the night and the frowning cliffs above produce upon the onlooker a feeling of awe and fascination. I am bound again to refer to Mr. Howell's eloquent tribute to the rapids, whether viewed by the light of day or the moonlike glow of the artificial illumination, I must agree with him that "I had schooled myself for great impressions * * * but I had not thought of the rapids taking me by the throat, as it were, and making my heart stop. I still think that above and below the Falls the rapids are the most striking feature of the spectacle."

The Early Wichita Electric Railway, Built in 1887

BY T. C. HUGHES

During the summer of 1885 the writer became acquainted with Dr. A. W. Adams, of St. Louis, Mo., who was at that time making some experiments in the propulsion of cars by means of electricity. His efforts had resulted in the production of a design which was considered by the parties interested therein to have met all difficulties in motor mounting. The method adopted in mounting the motor on the car is clearly shown in Fig. 1. Making arrangements to acquire a territorial right in the invention I started out to find a place and the capital to equip a full sized road with the system.

This quest landed me, during the summer of 1887, in Wichita, Kan., where I obtained the ear of J. O. Davidson, then president of the Citizens' Bank of Wichita. With him

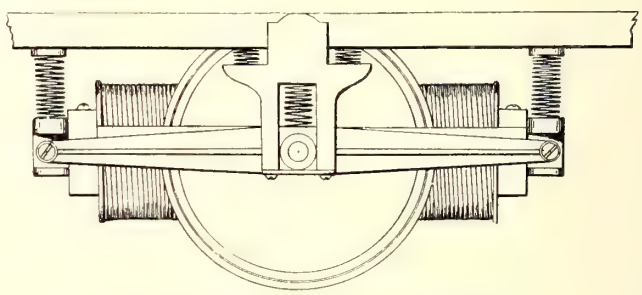


FIG. 1.—METHOD OF MOTOR SUSPENSION

and his associates I made a contract to build and equip with three cars some 5 or 6 miles of single track and switches, over a route commencing at Market and Douglass Avenue, then running north on Market to Riverside, thence west across the little Arkansas River to Riverside Addition and the Wichita Driving Tracks. From here the road extended north and west 3 or 4 miles through several new additions.

The work was commenced and carried forward both at St. Louis and in Wichita. The track was of 40-lb. Johnson girder rail, laid on ties and ballasted in the down-town portion.

A frame boiler and engine house, 40 ft. x 60 ft., contained two horizontal tubular boilers of 100 hp capacity each, a horizontal high-speed Smith, Beggs & Rankine engine of 100-hp rating, and a Brush generator, having an output of 60 amps. at 1000 volts approximately. The construction of the balance of the apparatus for the electrical equipment was in charge of W. L. Seddon, of St. Louis. The track work, power plant, etc., which was directly under my charge, progressed much faster than the manufacture of the electric machinery, and as the Wichita owners were pushing us for completion of the road within the time limit of the contract, many changes were made in the plans to procure the electrical machinery on time.

As many features of the construction were rather novel, and as no description has ever been given of them, I hope the following particulars relating to the details of this en-

terprise will prove both profitable and interesting history to the readers of the STREET RAILWAY JOURNAL.

The trolley wire was a hollow copper tube, $\frac{7}{8}$ in. in diameter and about 1-32 in. in thickness, made in lengths of 18 ft. Every 18 ft., or at the ends of each section of the trolley tube, an overhead switch was located, as shown in Fig. 2. The function of this switch was to cut out of circuit the section of live trolley wire directly over the car.

Two trolleys, pulled by a flexible cord, were attached to the roof of the car with spring clamps, one trolley being at the front, the other at the rear end of the car.

The distance between the trolleys was greater than the distance between the overhead switches, by probably 4 ft.

When, therefore, the front trolley opened the overhead switch the current would pass down to the motor through the rear trolley, and after traversing the motor would reach the overhead line again by the front trolley, the front trolley breaking all switches and the rear trolley closing all open switches, see Fig. 3. The current then reached the generator station by an independent pole line. In the overhead construction the trolley wire and switches were suspended from longitudinal cables attached to, but insulated from, cross suspension wires, fastened to wooden poles located on each side of the street. The trolley wire was suspended every 5 ft. from this longitudinal cable, each suspension wire being insulated therefrom, the return wire being carried on poles at one side of the street. At the generator station the return circuit was carried to a carbon-point automatic rheostat intended to throw in and out the field coils of generator, and thereby control the output of the latter.

The cars were of the Brill make, and were, if I correctly remember, 28 ft. over all, mounted on four-wheel trucks. The motors were mounted in a rigid frame, journaled at four points on the axles and geared to one axle with coil-wire belts. While this design of motor mounting did not conform to our ideas, we were forced to its use by stress of time to meet our contract requirements with the Wichita Company.

The trolley consisted of a frame carrying five wheels, as shown in Fig. 4. The under wheel would engage the switch points extending below the under surface of the trolley tube, and turn the wheel in the switch one-eighth of the way around, making or breaking the circuit as the case might be. Quite complicated overhead switches were designed for the turn-outs, but never erected. Instead, two wires were put up for that part of the line which extended from the power house to Douglass Avenue, with a single wire extending over the balance of the track.

In the operation of this line after construction, many difficulties were encountered, as I presume will be apparent to all electrical men, but which rather surprised the projectors at that time. Nevertheless enough experience was gained in the trial to enable the engineers to make a success out of it, except for financial difficulties in which the enterprise at that time became involved. It was then decided to abandon the series system and re-equip the road with a parallel system and to mount the motors as originally intended. This proposition was submitted to the St. Louis stockholders, but was rejected. Thus ended the first St. Louis effort to equip a practical street railway line with electricity.

The St. Louis company undertaking the work was known as the Advance Electric Construction Company, and the principal stockholders were A. W. Adams, W. L. Seddon, H. L. McPheeters, Seth W. Cobb, D. R. Francis, Charles Hoyle and Ewing Hill.

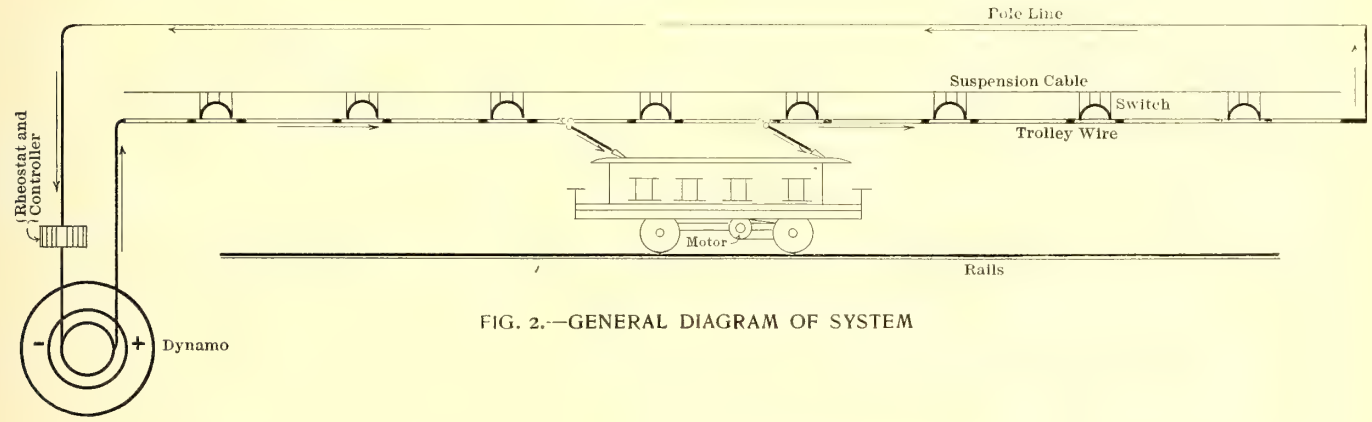


FIG. 2.—GENERAL DIAGRAM OF SYSTEM

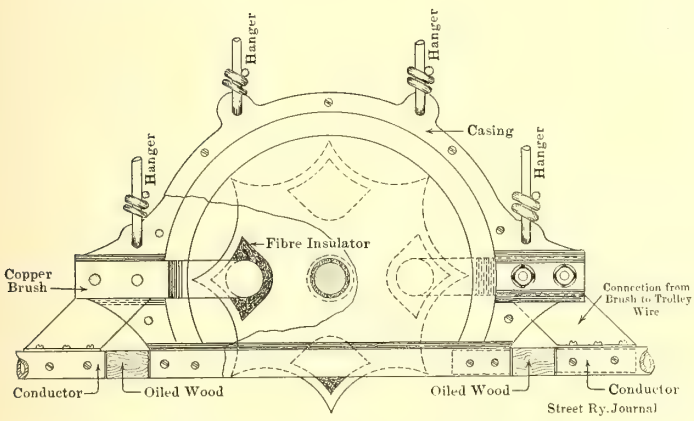


FIG. 3.—MAKE AND BREAK SECTION INSULATOR

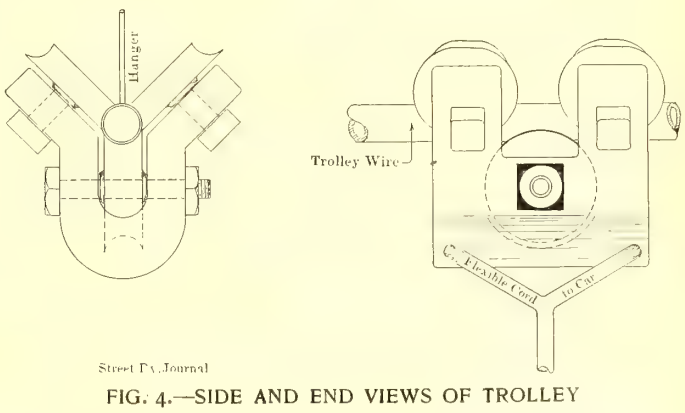


FIG. 4.—SIDE AND END VIEWS OF TROLLEY

A concession for an underground electric line in Buenos-Aires, Argentina, has been granted to Carlos Bright, an American engineer, having an office at 874 Cuyo Street, Buenos-Aires.

A railroad known as the Anglo-Argentino Tramway Company, having offices at 3583 Rivadavia Street, Buenos-Aires, has made application for permission to change its traction over to an electric system.

Can Small Electric Roads be Operated at a Profit? II and Conclusion

BY JAMES BLAKE CAHOON

An important consideration for a road operating in a small town is that of the track, for it may be taken for granted that this class of roads cannot afford, and in fact, it is not necessary for their moderate traffic to put in, as expensive a track as is necessary for the larger cities. Still, it must be amply heavy for the work to which it will be subjected, and must be so built that the repair account will be as light as possible. The City Councils are sometimes inflated with their own importance to such an extent that they fully believe that they know more about the construction of the roadbed than the railway people do themselves, and where this occurs, they are very apt to impose restrictions and specifications such as are only justly applicable to the larger cities. As a general rule, these specify that the road must lay a deep girder rail, not less than 6 ins. in depth, with a flange not less than 2½ ins. in width, through the main streets of the city, and they often compel the laying of this class of rail everywhere inside the city limits; they also impose the paving of the road between the rails and for a distance of 2 ft. outside, when, as a matter of fact, about the only paving in the city is that on the main business thoroughfare, yet they will permit a steam road to lay T rails, and often without any restrictions as to paving.

This is presumably on account of the general feeling that the electric road is going to be the most profitable enterprise that has ever been in the city. This idea is well illustrated by an actual fact that came under my own observation in an accident case that was being tried some time ago. The gist of the matter was that a man went out from his house to get a car, which was an open one, and without waiting for the car to stop, reached out for one of the handles with the intention of jumping on, but missed his grip with one hand, and was dragged for a few feet alongside the car. When the car was stopped, he recovered himself, jumped on and went on down town about his business. The conductor at the time asked him if he were hurt, and he answered in the negative. About a year afterward he brought suit against the road for $10,000 damages, on the ground that this accident was the cause of a double hernia. The evidence was practically all in favor of the road—the jury were unable to agree, and it cropped out later that the point of disagreement was solely on whether they should give the man $1,000 or $4,000, the argument in favor of giving him damages being that the road was a rich corporation, and the man was poor and ought to have something, anyway. This case was subsequently settled, in view of this fact which was brought out, for $400 in preference to letting it go to trial again. As a matter of fact, this road was only just about earning its operating expenses, and the prospect of paying any dividend was far in the dim future, yet the general feeling among people was that the road was earning a large amount of money.

Coming back to the question of track—it seems to be generally conceded that for this class of roads T rail construction is the best, and the nearer it comes to steam road construction, the better. I believe if this class of roads could build their roads with 70-lb. T rails, placed on a subfoundation of 6 ins. of broken stone, ballast them up even with the surface of the ties with the same material, fill them up practically level with the surface of the rail with ordinary dirt, or, preferably, gravel, use a long, heavy splice bar, and place ties every 2 ft., using for the latter a tie having not less than 7-in. face, 6 ins. in depth, and 8 ft. long, that the track could be maintained with a minimum amount of repairs. Even with this construction, I consider it necessary to maintain a small track gang, and keep them going over the road the year round, and this work should be done systematically and thoroughly, and not have the road gone over in a general way in the spring and again in the fall, and left to take care of itself the rest of the year. I have tried both methods, and am satisfied that the cheapest method is to keep a small gang at work continually. For the ordinary ten to fifteen car road, with a mileage of from 15 to 20 miles, three men will take care of a road built as above, and keep it in good shape without any difficulty. If, however, the road is built, as probably the majority of roads are, on the ordinary dirt foundation, there will be more or less heaving in the spring, and it will be necessary to supplement this gang at that time.

The question of paving is an especially sore point with the small railway. John W. Boyle, president of the Utica Belt Line Street Railway Company, in an article in the Utica *Herald* March 23, 1899, treated the subject of paving from a railway standpoint in a most admirable manner, and brought out very clearly the point that the street railway is not benefited in the least by paving. He states that pavements are built only at the request of abutting property owners. They secure the pavement and pay for it for their individual convenience and benefit, and this is so well recognized that the law compels them to pay two-thirds of the cost of the pavement and the city one-third, on the ground that the abutting property owner is the person most benefited. The street car is the only vehicle in the street which furnishes and keeps in repair at its own expense that portion of the street on which its wheels revolve; it is the only vehicle which neither wears out nor litters the pavement. He further makes the point that after a pavement is laid, it becomes a constant source of inconvenience and expense whenever work is necessary upon the tracks, and the railway company is expected to, and does bear this increased expense for an improvement which is made for the benefit of everyone in the city except itself.

If people want rapid transit in the small cities, the fact is beginning to force itself home that they must either lighten the burden imposed upon the railway corporations, and work with them and assist them in every way possible, or else this class of railway will be obliged to retire from business. Financial men are not, as a rule, putting their money into enterprises from motives of pure philanthropy, but do want to see and expect to receive a fair return for the money invested. If onerous laws are enacted, and penalties in the shape of paving and expensive track construction imposed, rendering it impossible for these roads to pay any return on the investment, capitalists are going to withdraw from this class of investment, which will result in either the abandonment of this class of roads or shifting the burden upon the local people. Some years ago it was not a difficult matter to float bonds to build a road in a city of any fair size, but a letter which I received only the other day in regard to financing a projected road well illustrates the feeling which bankers have in regard to these propositions at the present time. Quoting from a letter dated July 17, 1900, they say, "We regret to state that it is unlikely that we shall be interested in the way indicated, as we do not undertake the financing of companies except with a record *behind them*." Another firm of bankers, referring to the same proposition, says, "We are not financing uncompleted roads." These quotations in general illustrate the feeling among the banking element in regard to furnishing the funds for building roads at the present time. The numerous railway laws that have been passed in most of the States impose the same restrictions upon the

small road as upon the large, making no attempt to distinguish between the two, although common sense shows that a provision which might be a minor charge against a big road would be a crushing burden on a small road; it is high time that the small road, as well as the people, recognize this fact, and take the necessary steps to secure the repeal, and readjust the railway laws so that the burden, be it in the form of taxes, construction or paving imposed, shall not be more onerous to the small road than it is to the large.

I think it would be fair to assume that the majority of the small roads have been built by contract, and where this occurs, invariably the repair account is a large one; this is particularly true of the overhead line, largely due to the fact that when the roads were built the idea of calling in a consulting engineer to draw up specifications and supervise the work was not in vogue, and the result is that the line was put up in a slipshod way, with cheap materials, and has been giving out ever since. There is no part of the road where it pays to do as good work and put in the best of materials as in the line, one reason being that the pressure is on the line for about eighteen hours a day, and if the line is not well insulated there is a constant loss owing to leaks, and this loss represents coal at about $2 per ton usually. In this connection, I wonder how many of the small railways in the country make a thorough and systematic test of their lines to determine whether they are properly insulated or not. I will wager to say that not one in ten do it, the general rule being to let the line take care of itself until a break occurs in the line or an insulator gives out; they then send out and fix that particular break, return the tower wagon to its shed, and wait for another break. It is not a difficult matter to test the line out for grounds and leaky insulators, nor does it cost very much to do it, and as a matter not only of precaution but of good horse sense, it ought to be done at least once a week where there is reason to suspect that the class of insulators is not of the best; where the line is built of first-class materials, it still should be subjected to tests for grounds at least once a month. There is no better criterion of the management of a road than the general appearance of the overhead line as one goes over the town. If it has a slipshod appearance, poles out of line, the line itself baggy in one place and too taut in another, insulators with fur on them, line out of center, etc., it is pretty safe to conjecture that the road is not paying. It is not the great big things that conduce so much to economy and rendering the road a profitable investment, as it is the little things, and of these little things a general air of neatness is the chief.

The next subject that demands our attention is that of the car houses and repair shops, and how they should be taken care of to secure the best results at the least cost. The car houses of many of our small roads remind one of a junk dealer's, largely because of the small force employed and the little if any attempt made to keep things clean and in order. Gears, pinions, parts of motors, trolleys, and even cars themselves become worn out, and are thrown to one side in the corner of the car house and left to take care of themselves. Repairs are usually made wherever the car happens to be in the car house, and everything is left lying around in a perfect hodge-podge of disorder. There is really no necessity for this, and it leads to slipshod methods in the care of the cars and everything else. There is even more necessity for order and method on the small road than on the large, and the car houses should be laid out particularly to facilitate work. The car house should not be a machine shop, or a carpenter shop, or a paint shop—there should be the car house proper, in which the cars are housed, and at the rear end there should be provided separate rooms, preferably arranged as follows: Facing the car house, at the rear end and on the right half, place the wash room for washing cars, in rear of this the machine shop; on the left, the carpenter shop, and in rear of this the paint shop. Many roads wash their cars at night wherever they happen to stand on the tracks in the car house, and the result is that the car house is always damp, and consequently when a car is allowed to stand in there for any length of time, moisture gathers on the fields and armatures of the motors; after this has been repeated a few times an armature or a field burns out, and then the apparatus is blamed.

As a matter of economy, it is much better to have a separate wash room with proper drainage, wherein the cars can be washed. In this connection the care of the cars comes up, and after trying various methods, I am thoroughly convinced that the best is to provide a sufficient number of cars so that every car may be thoroughly washed, cleaned and given a brief overhauling every other day, doing this in the daytime, and not at night. Night inspection of car equipments and washing of cars do not accomplish the best results. When the cars come in after the day's run, half of them should be run on a track so that they can be taken care of in the manner indicated on the following day; the other half should be gone over to see that the grease cups are full, and brushes and brake mechanism in good working order. This small amount of inspection can be done by the night fireman of the power house, assuming that the car houses are situated as they should be, alongside of the power house. In addition to the inspection mentioned above, motors should be dropped from the cars periodically and thoroughly overhauled in the machine shop, commutators turned down, new bearings put in, and any general repairs needed to the motor equipment done at this time. In regard to the car bodies themselves, the utmost care should be taken to see that these are kept up in a cleanly condition and looking reasonably bright. Under ordinary conditions of operation, cars will need revarnishing once a year for two years, and the third year they should go into the paint shop and have the paint removed down to the wood, being repainted afresh. Many roads make a contract with some local painter to do this, while other roads, operating ten to twenty cars, find that they have work enough to keep a painter busy the year round. I believe the latter plan to be the better one.

The ordinary working force required to take care of cars of this size road under these conditions are a good machinist and helper, a carpenter who is also a blacksmith and general allround handy man, a painter, and a lineman who is also an armature winder and can take care of repairs to the armatures and fields, in addition to looking after the line and acting as starter to get the cars out in the morning. To keep things looking somewhere near decent, it is advisable to have the car houses and all shops thoroughly cleaned and inspected once a week, the rule I followed being to have the men clean up Saturday afternoon, then I would thoroughly inspect all buildings on Sunday afternoon. We built a bin in the rear of the machine shop, into which all broken gears, pinions and scrap of all kinds were thrown, and a junk dealer came regularly the first of each month and cleared this out. There were no excuses taken for the buildings not being thoroughly clean and in good order at the times mentioned—they simply had to be, and once the men understood this, there was no further trouble. One result of this was to make the men careful in their work, and to overcome the natural tendency to waste things, and the consequence was a marked decrease in our repair account. In the power house, where there was little

necessity for disorder or dirt, everything was required to be clean and in good order by 10 o'clock daily. There was very little trouble about this, as engineers are usually proud of their machines and take good care of them.

After all that has been said in regard to the property itself, when we come right down to the meat of the matter, the success or failure of a road depends very largely on three factors: First, the manager; second, the employees, and third, the cordial co-operation of the two preceding. As a rule, the class of men making up the employees of the small roads are drawn from the town itself, usually born and brought up there, and on the great majority of roads more or less difficulty is encountered in keeping the same men in the service continuously, due largely to the fact that the young fellows in the course of two to five years want to get into something that will pay better, and incidentally take them more out of the public gaze, many of them being inclined to look on the occupation of conductor of a street railway as pretty near the next thing to working on the street with pick and shovel. Hence it is that the younger element do not make as good conductors as the married men with a few years added to their age. This does not seem to be true of the motormen, and it is hard to discover a reason for it. I remember at one time a bright young fellow, who had been a conductor for some three years, and who, during this time, had an almost perfect record, came into the office one day and said that he had decided that he wanted to leave our employ. I sounded him a long time as to cause, and finally elicited the fact that he was engaged to be married, and the young lady to whom he was engaged did not like the idea of his working any longer as a conductor, and much preferred that he seek some other work. I asked him what he had in mind, and he said that he had been offered the position of brakeman on one of the steam roads. I told him I would give him a vacation for three months, and if at the end of that time he still entertained the same feelings in the matter, I would accept his resignation; if he did not, he could continue with the company. At the end of two months he came to me and said that he and the young lady had come to the conclusion that after all it was better for him to stay in the employ of the company, and so far as I know, he is there to this day.

It is often remarked that the discipline on this class of roads is not as good as on the larger, yet I see no reason why the discipline should not be better, provided the characteristics of the men are carefully studied. There is, of course, a tendency among them to be more or less hail-fellow-well-met with all their friends, and as they do not have to be as much on the alert, and look after things as sharply as on the large road, there is a tendency to chat with the patrons of the road and take life as easily as possible, but this can be counteracted through the cultivation of a proper esprit de corps, and infusing into the men the idea that on their efforts largely depends the financial success of the road. The manager comes more into contact with each individual than can possibly be the case on the large road, and hence has a chance to instill much of his individuality and methods into their minds and lead them in such a way that they are glad to work for the interests of the company. Many roads do practically nothing for their men, and when the advisability of establishing a club room for their employees is mentioned, they dismiss it with the single remark, "Oh, we cannot afford to do that." As a matter of fact, they are the very people who should afford to do it.

It does not cost very much to fit up a waiting or club room for the employees, with a billiard and pool table and the current literature, with a few good books of reference and some of the standard games. I believe I was the first manager of a small road to do this, as also to introduce the longevity system of paying the men and giving them service stripes in accordance with the number of years of service, and certainly I did not, and I know the men never regretted the taking of this step. Prior to this the men had no place to wait for cars whose men they were to relieve, and consequently drifted into saloons. In this particular town, all cars came into a common center, and the relief was made there. The car houses were situated nearly 2 miles from this point, so that it was practically impossible for the men to have any headquarters there. At first I took one fairly good-sized room on the second floor of a block on the corner of the main business street, at a point where the road turned the corner. From this the men could see their cars coming, and be ready to meet them promptly.

In fitting up this room, it not being large enough for a billiard room, and I being at the time unable to get other quarters, I carpeted the room, heated it, and provided card tables and several of the common games, like backgammon and cards, and the daily papers, including a New York paper, the weekly illustrated papers and half a dozen of the illustrated monthly magazines; there were also provided enough chairs and odd tables to take care of the average number of men who would find their way in there, as well as a clock and a telephone. This worked so well and showed such good results, that by renting the whole of the second floor of this block, I was able to secure a large room adjoining the former one, which we fitted up as a billiard room, putting in the tables and paraphernalia at the expense of the company. The question that came up in my mind at this time was how to handle the billiard tables—if the men were allowed to use them haphazard and just as they pleased, without being held responsible in any way, the chances were that they would be knocked to pieces in a very short time, and the thought occurred to me, "Why not treat this as we would in a private club? Whoever uses the table pays for it." There was this difference, however, that we could not afford to keep anyone to look after the tables and collect the payments. I believed that the men could be trusted in the matter, and therefore had some little printed slips made up in pads of one hundred, and instructions were issued that for every game the man who used the tables was to fill in his name on the slip and deposit it in the box provided for that purpose. These slips were collected once a week, and deductions made from the men's pay at the rate of 2 cents for each game, the loser of the game paying for the game. The revenue derived from this source was kept separately, and used for the maintenance of the tables, and anything in excess applied to the reduction of the rent of the rooms.

The balance of the rooms on this floor were rented for a sufficient rental, such that taken in connection with the receipts from the billiard tables, the rooms practically cost the company not over $10 per month, and I have always considered this as one of the best investments the company ever made. It did much to get the men together and keep them out of saloons and from hanging around street corners, and acted as a leaven to materially raise the esprit de corps, with the result that the men felt that they were not working for a soulless corporation, who did not care a continental whether they were taken care of or not, or whether their work was made easy or light, but they did feel that the company had their interests at stake, and we frankly told them that we were doing all we could afford to do and a little more. We did not hide our receipts nor our expenses from them, but told them frankly what they were and just how we came out year by year, and as times picked up and the receipts increased, we were able to do a little more for them, and did not hesitate to do it. The men, feeling that the interest of the company was their in-

terest, worked to further that—they were polite and attentive to passengers, took care of ladies and children, helping them on and off the cars, and in fact worked as though they really did have a financial interest in the success of the company.

Another thing which we did was to help the men in the matter of uniforms. When I took hold of the company, the men wore about anything they pleased in the way of uniforms, the principal thing being a blue coat and cap, with the word "Conductor" on the latter, and as each man had his own ideas on the subject, the styles were anywhere from a steam road conductor to a farmer. Having been brought up myself to see men in the neat uniform of the navy, it certainly grated to see this slipshod condition. Feeling that it would be a hardship to the men to force them to buy a new uniform at once, I suggested that they appoint a committee of five to select cloth and style of uniform, and told them that I would get bids from the different tailors, and that they could select the tailor and I would have him make the bid on a cash basis, the company paying for the uniforms and the men paying the company at the rate of $1 a week for the men having full pay, and a proportionately less amount for those receiving partial pay. In this way the men were able to get the benefit of a spot cash payment, which saved them about $2 on the cost of a uniform.

I found this committee to work well in the matter, and suggested to the men that they keep this committee or elect another to confer at any time when any points came up that seemed to need talking over. The only point that ever came up subsequently on which the committee needed to act was when the men in the winter time wanted to give a ball, and wanted to know what could be done in the way of taking their guests home when the ball was over, this being about 3 o'clock in the morning, after the cars had stopped running. This we readily fixed by telling the men that if they were willing to run the cars, the engines would be started up in the power house in time for them, and they could take their guests home without charge. In the summer time we also gave the men an outing, in the shape of a trolley ride with decorated cars, and let them invite their wives and sweethearts. After some two or three years union men from other cities came to our road and tried to interest our men in forming a union. The men promptly told these emissaries that there was no need of their joining anything of the kind, that they had all the union they wanted in their own club room, free, and I rather gathered from what leaked out subsequently that these representatives thought it advisable to leave the city on the first train, and it did not matter particularly where that train was going.

Too much care cannot be used in the selection of employees for this class of road; for the manager, it is almost like taking a man into his own family. Good men can be obtained, and therefore it is poor policy to take anyone who comes along and applies for a place. There is no point on which a manager needs to exercise more strictness than on this. Reference should not only be required, but should be examined into carefully, not necessarily by the manager himself, but by one of his aids, who reports on what he finds out of the man's past career, his habits, manners and customs, and the reasons why he is out of a place, or wants to leave his present place. We made it a rule never to take a man over thirty-five years of age, and for a motorman one of the requirements was that he should be a good mechanic or stationary engineer, and as vacancies were of infrequent occurrence on our road, we were able to hold to these requirements very strictly. When men were selected they were put through a course of training, motormen being sent for two weeks to work in the power house, followed by two weeks in the repair shops, then a week's instruction in operating cars, after which they were required to pass a written examination.

The training of the conductor, while not so thorough as this, was still sufficient to ground him in his duties before he was allowed to take a car, and he also was required to pass a written examination before he was accepted. Men coming in in this way were placed on the extra list, and were given a regular run in order of seniority.

Finally, I believe this class of roads can be made to pay if they are treated as has been indicated in this article. Each individual problem must be worked out, but in general it may be said that, given good equipment and good track kept up in first-class condition, a good manager who will show people that it is working not only for the interests of the company, but for their interests, and who can secure the co-operation of the employees, will make a road of this class pay.

Extension of the Plant of the Worcester Consolidated Street Railway

The Worcester Consolidated Street Railway is located in a thriving business town where the opportunities for a successful street railway are unusually good. Not only is the local traffic considerable and uniform, the cars being well filled on all the lines at all hours of the day, but connections are made with a large number of suburban lines. Among these are the Worcester & Webster, Worcester, Boylston & Clinton, Worcester & Leicester, and a half dozen other roads which connect with Fitchburg, Hudson, Leominster, Grafton, Oxford, Webster, Leicester and most of the principal towns and villages of Central New England. Through transfer systems and arrangements for joint use of tracks the road has been placed in a unique position, practically controlling the largest mileage, without exception, in New England, although its own tracks cover only about 65 miles.

Several of the neighboring roads have recently been acquired by a syndicate, and the question of consolidating the different suburban power stations has arisen, with the result that in the immediate necessary extension of the Worcester plant provision is being made for such additional equipment as may be needed to operate not only the Worcester street railway lines, but all the combined suburban roads. The power plant necessary for this immense system will be, with the exception of those controlled by the Boston Elevated Railway Company, the largest in New England.

The Worcester roads are all practically concentrated within the city limits, with the exception of the Worcester, Grafton Center and North Grafton line, which is also a part of the consolidated system. An average load of seventy double-truck cars is carried for about eighteen hours summer and winter, and the power-station output, under the same conditions, amounts to about 1250 hp. This is increased somewhat in the early morning and late afternoon hours, but the daily load factor is very high. The maximum current (exclusive of snow storms, etc.) is on a summer afternoon, say during a ball game, and sometimes rises to 3600 amps.

The power plant is located in the southern part of the city, near Webster Square, within 100 ft. of the Blackstone River, which furnishes an ample supply of excellent water the year round for both boiler feed and condensing purposes. A side track from the Boston & Albany Railroad leads to sheds alongside the boiler room, where capacity

for a month's supply of coal is provided. The building is of steel construction throughout, with light brick walls, the shaft center lines and boiler fronts being parallel and at right angles to the roof trusses, which are parallel with the gable ends. The extension, which is at the southern end, is being built without disturbing any of the existing construction. The present plant is 100 ft. wide and 120 ft. long, divided near the middle of its length by a 12-in. brick wall with only two doors, one at the end and one between the two batteries of boilers. The west wall abuts on the sidewalk, but there is ample room in every other direction, there being five acres of land in the property. At the northwest end of the engine room is the office of the superintendent, which is elevated about 12 ft. above the floor, giving a good view from the desk of every engine and generator. There are two monitors extending the entire length of the roof, one over the center of the engine room and one over the steam leaders above the boilers. The stack is steel, 100 ft. high, and rises from within the boiler room. The engine room floor is of latticed iron bars 10 ft. above the basement floor, so that the heating and condensing apparatus, piping, etc., are constantly in sight of the engineers. Each valve on the basement piping is connected with stands and rods, so as to be operated from the engine room floor.

The equipment consists of twelve horizontal, tubular boilers of 200 hp each, set in two batteries of nine and three units each; four 500-kw and one 850-kw generating sets, the four being belted, and the larger set direct coupled. The engines are all vertical, cross-compound condensing, built by the Lake Erie Engineering Works. The generators are of General Electric make. Most of this equipment was installed about seven years ago, and the generators especially are somewhat antiquated. In spite of this fact, however, the plant has run continuously for the seven years without a breakdown, and during that time has not been operating non-condensing for a single hour. The 850-kw unit has been running practically without a stop twenty-four hours daily for two years.

The condensing plant consists of a 500-hp Goubert feedwater heater and Worthington horizontal duplex independent jet condenser. A box crane rated at 8 tons, but frequently used for 30,000 lbs., and operated by hand, runs over the engine room. A 118-hp General Electric booster outfit, direct connected, is used for the "Lake line," raising the potential to about 650 volts, for transmission to the furthest distant point of the whole system, at Lake Quinsigamond, which is about 9½ miles from the plant.

The piping is arranged in duplicate for security against breakdown. Each of the first nine boilers is connected through a square bend to a T looking upward. From the run of the T a straight pipe leads to one header, and the other header is connected to the outlet of the T by a U bend having a valve at its highest point. The boiler mains are 6 ins., the two headers 12 ins. The last three boilers, which have only recently been installed, are each connected through a 6-in. long bend to an 8-in. header, from which two 8-in. U bends lead, one to each of the main headers. Steam to the engines is taken from Ts on the header through long sweep bends to the engines. No separators are used. The drips from the steam mains and headers are returned through traps to the boilers. These will eventually be superseded by some form of gravity return system. The engines exhaust into one 16-in. main, to which the condensers are connected, so that any condenser may be used on any engine. Neither mechanical draft nor economizers are used. The efficiency of the station as a whole has been moderately high, as compared with that of similar plants with more modern apparatus, but the operating expense per car mile has been low, and an average evaporation by the boilers of nearly 10 lbs. of water per pound of coal, with 170 degs. as the temperature of feed, is often reached, although they have been driven beyond their rated capacity.

The addition to the station will be 100 ft. in width and 90 ft. long, and will be of the same general construction as the existing portion. A broad monitor roof will be built over the engine room, which will consist of two bays 30 ft. and 16 ft. wide, respectively. The center bay, which is to contain the main engine, will measure 43 ft. from floor to bottom of roof girders, and will be surmounted by a 23-ton crane built by the Wrought Iron Bridge Company of Canton, Ohio. The smaller bay will have a 5-ton crane under a pitch roof. The boiler room, on the eastern side of the addition, will be an extension of the existing boiler room, and will permit of the installation of nine new boilers, making twenty-one in all. This room is 44 ft. wide and 16 ft. high to the lowest portion of the trusses. The roof is pitched up to a height of 38 ft. at the 12-in. dividing wall between boiler and engine rooms. The side walls of the addition are merely for filling in the steel work and are 12 ins. thick. The roofing is the H. W. Johns Manufacturing Company's asbestos paper; the flooring, granolithic on I beams and brick arches. There will be no basement, properly speaking, the condensers, etc., being planned to rest on the main floor, while the engine cylinders will be reached from this floor by a winding staircase. There will be a low, studded basement room under the westerly bay of the engine room, the purpose of which will be mentioned later. The main engine bay will be of sufficient size to contain two units of the size of the one now being installed. There will be space also for an additional 150-kw, direct-connected booster, which will become necessary if the plant is used to operate distant suburban lines.

The main floor of the smaller bay in the engine room is strengthened to support several three-phase rotary converters, which would in this case be required. The basement under would be ventilated by cone fans for the proper reception of step-up transformers. The rotaries would then take direct current at 550 volts from the main generators and deliver alternating current probably at not over 500 volts to the transformers. Here it would be raised to something above 2000 volts, the precise potential not having yet been calculated, and transmitted to various outlying sub-stations, where other rotaries would transform it to direct current for street railway use. All this is, of course, a matter of future probability, no transmission apparatus having been contemplated in the present stage of equipment.

The immediate extension for which the building has been thus enlarged consists of a 1600-kw, direct-connected generating set, which will be erected in October. The engine, which is being built by the International Power Company, of Providence, R. I., is a vertical cross compound, running at 100 r. p. m. The cylinder diameters are 32 ins. and 66 ins. respectively; the stroke, 48 ins. It will be the largest engine of its type in the country, with the exception of that recently purchased by the Boston Elevated Railway Company. It is of special design throughout, the novel features originating both with the builders and the railway company, many of the points being specified by Mr. McKee, the chief engineer of the plant. The high-pressure cylinder will be steam jacketed over the whole of its surface, the low-pressure cylinder on the heads only. A live steam reheater will be used between the cylinders. Lever throttles and lever by-pass valves will be used throughout, the general construction being closely in accordance with marine practice. A by-pass from the

main steam supply will be run to both sides of the low-pressure cylinder beneath the inlet valve.

The foundation for the engine will measure 35 ft. 8 ins. x 22 ft. at the top, and will be 13 ft. deep. The sub-soil is of first-rate quality for a footing, and the exposed work will be of Portland cement and broken stone concrete. The fly-wheel is 18 ft. in diameter and weighs 60 tons. The height from floor line to top of engine is 27 ft. 2 ins., so that a man standing on top of one of the cylinders could almost reach the roof girders. The shaft is of steel, solid, 20 ins. in diameter. The low-pressure cylinder is cast by a new method, which has been entirely successful. The shell and chest were made in three parts, the dividing lines being near the heads. The faces of these three parts were then machined, packed with very thin copper gaskets and securely bolted together. They have not been taken apart since, nor is it expected that they will be. The machining, including boring, facing and drilling, has been done on the three castings at once. The reason for so casting the cylinder was to provide for repairing a possible breakdown without getting a new cylinder. Should a head blow out taking a piece of the body flange with it, as it sometimes does in the power plants, the broken casting could be replaced in a short time by a new one made from the same pattern and machined to templates, and the new piece could be bolted in while the engine was in place on its frame.

Another unique feature is the valve motion. This, instead of being operated from spur gearing, as is usual in this class of engines, is actuated from two eccentrics set on the main shaft, one on the center and one on the quarter. The eccentrics transmit the motion to an auxiliary shaft, to which the rods are connected as in ordinary practice. As the rods are of extreme length, there will be no trouble occasioned by their angular displacement during rotation. The valves are of the endwise gridiron type, conforming in general design to the standard form of the old Green-Wheelock engines, and the clearance has been reduced by their use to less than 3 per cent. The main bearings are 20 ins. x 36 ins., and the generator outboard bearing 16 ins. x 32 ins. These are of the shell type, with water jackets. A small steam pump will maintain a gravity tank flow, or forced flow, if necessary, around each bearing piece. The bearing caps, instead of being fastened to the bases with stud bolts, will be connected with long T end bolts, the Ts setting in slots in the bases, which can be reached from the outside. This will render it quite easy to remove and replace the caps and fill the shells. The oiling will all be done mechanically, as it is in the present station. A supply tank will be located near the roof and a receiving tank in the basement. The oil will flow from the supply tank to the bearings, the regulation being by hand, and thence to the receiving tank. A small pump will take it from the receiving tank through a filter and force it to the supply tank again. A connection from a supply barrel will be made to the pipe between the pump and the filter. A Holly gravity drip system, soon to be installed, will carry all the live steam drips to a receiving tank, into which the low pressure drains from heaters, etc., will be brought. A small reducing valve blowing high-pressure steam into the heaters will give the required upward velocity to the condensation, which will thus be carried above the water level in the boilers to a supply tank, from which the return boiler feed will be through check valves to the blow-off pipes inside the cocks. This system will be entirely automatic and will be in continual operation except when a boiler is being blown off.

The exhaust from this engine will be carried to a 2000-hp Wainwright vertical heater of the "easy flow" type, especially designed for this plant. The heater body, which is 40 ins. in diameter, will be divided longitudinally into three compartments at the top and four at the bottom by webs, or fins, cast in one piece with the shell. The length of the body of the heater is 16 ft.; that of the tubes 124 ins. One hundred and fourteen $1\frac{1}{2}$-in. tubes are used, the total tube heating surface being 671 sq. ft., making a ratio of a little less than 3 hp to the square foot of heating surface. From the heater the exhaust will pass to the condenser, which is also of special design. This is a twin simplex beam vertical air pump and jet condenser, built by the Geo. F. Blake Manufacturing Company. The steam cylinder is 14 ins. in diameter; the water cylinder 35 ins. The stroke of both pistons is 21 ins. The floor space occupied is 7 ft. 4 ins. square, and the total height of the condenser from floor line to beams is 11 ft. 7 ins. The outfit is designed to give an even vacuum of $29\frac{1}{4}$ ins. of mercury with injection water at 70 degs. F. The water of the Blackstone River, which is to be used, will rarely rise more than 10 degs. above this temperature on the hottest days of summer. The vacuum maintained will, of course, have an important bearing on the economy of the engine as guaranteed by the builders. The contract calls for a steam consumption of the main engine, when operating at 125 lbs. steam pressure, not greater than $12\frac{1}{2}$ lbs. (dry) per i. h. p. per hour for any range of load between 1800 and 2500 hp. The vacuum under which this economy must be made has not been stated. With any practicable vacuum, however, so low a steam consumption at 125 lbs. steam pressure is almost unprecedented, and the result of the tests when they are made will be received with general interest. As the contract contains a forfeiture clause involving a heavy penalty for every 1/10 lb. of steam consumed in excess of the guaranteed rate, the engine will no doubt be a record breaker in its class. If the tests are made by weighing the exhaust steam condensed in a surface condenser and the indicators are accurate, the results ought to be authoritative.

The generator is one of the General Electric Company's multipolar railway type, running nominally at 550 volts at 100 r. p. m., and 10 per cent over compound. The machine has twenty-two poles. The distance across the field ring is 21 ft.; the armature is 164 ins. in diameter and the commutator 120 ins. The normal rating is 1600 kw, but provision is made for 25 per cent overload. The floor space occupied is 6 ft. x 21 ft., and the total height from base of bed to ring is 22 ft. The height from the top of the base is 14 ft. 6 ins. The machine will form a decided contrast to the old-fashioned octagonal field-ring generators now in the station. It will do well if it makes a better record. One of the commutators on a 500-kw generator which has been running steadily for seven years has only been turned off once in that time, and is to-day in almost perfect condition. The worst commutator of the lot is on a machine just opposite a doorway leading to the street. This has been turned down three times—about $\frac{1}{8}$ in. in all. All of this old equipment is working daily, the only perceptible defect being a slight weakening of the insulation.

The General Electric Company is building a switchboard for the new plant, which will take the place of the one now in use. Several of the present instruments will be utilized. The board will be constructed of black slate, in twenty panels; two for the boosters, six for the machines and twelve for the circuits. Should the developments already mentioned take place there will have to be added one machine panel, two or three feeder panels and several for the rotaries.

Instead of having connections separately from the positive, negative and equalizing wires to the board, a main negative bus is used, into which the negative wires of all

the machines are connected. By putting in the negative switch first the generators can be coupled in multiple. In other respects the board and wiring system will conform closely to standard railway practice.

Mention has been made of the rotaries and static transformers which may have to be installed very soon. The system will in this case be unique. The ordinary transmission plant uses alternating-current generators with step-up transformers if necessary and rotaries at the sub-station In this plant only direct-current machines will be used, and there will be four transformations: from direct to alternating current, then to high potential, then to low potential, and finally back to direct current. The reason for adopting such a system lies in the fact that a large amount of the equipment is already in place and that for best economy the large units must be used on the city lines. To fill these conditions direct current is a necessity and the loss by transformation through rotaries unavoidable.

Paris Exposition Notes

[*From Our Regular Correspondent.*]

It would be impossible to give in the pages of the Street Railway Journal, which it is possible to devote to the subject, even the briefest description of all the street railway exhibits at the Paris Exposition. The most important exhibits, however, have been mentioned, and readers of the paper may be certain that they have been able to acquire a knowledge of the street railway exhibits at the Exposition in this way much more readily and systematically, even if not so much in detail, than would have been possible by a visit to the Exposition itself. As already stated, the street railway exhibits are distributed around the Exposition in a dozen different places, so that it is almost impossible to locate them, and one would hardly be surprised at coming across some tramway exhibit in almost any section. Again, the delay, attributable principally to the Exposition authorities, in getting the exhibits in shape and under way, has added very much to the general confusion, and many exhibitors were glad to accept almost any space rather than to wait indefinitely until the space previously assigned them was ready for occupancy. This has added very much to the difficulty of locating many of the exhibits.

Mention has already been made that among the street railway exhibits American apparatus is predominant. Among those not previously described is that of the Lorain Steel Company, of Johnstown, Pa., and the Bullock Company, of Cincinnati, Ohio, who have a joint exhibit in the Electricity Building. Here the former company shows a number of Dupont trucks for single and double-truck cars, equipped with standard Steel motors. These motors range in size from 25 hp to 50 hp. A number of controllers, trolley poles, rheostats, etc., complete the exhibit. The Bullock space is devoted largely to Bullock generators. These are necessarily of the smaller sizes, but views are shown of 800-kw railway and power generators manufactured by the company. The American Steel & Wire Company has its largest exhibit in the mining section, where are shown samples of ore mined by the company, wires of steel, iron, brass, copper, aluminum, etc., varying in size, rail-bonds, etc. The Roebling Company has exhibits in both Electricity Building and in the Mining Building; the most conspicuous object in the former is a model of a conduit electric railway system, to show the method of connecting the feeders to the conductors; in the latter is shown a handsome model of the Brooklyn Bridge. The General Electric Company, in addition to the elaborate exhibits made by its representatives in Europe, and particularly by the French Thomson-Houston Company, has also an exhibit of its own in the Electricity Building. The feature of this exhibit is an elaborate model of its three factories made to the scale of 20 ft. to the inch. These models are constructed of sheet zinc and copper and beautifully colored, and every detail is reproduced. In addition, the company shows photographic views of its works and of some of the most important installations made in America and abroad. The Triumph Electric Company is making a joint exhibit with the Fay & Egan Company, of Cincinnati, Ohio. Part of this exhibit is located in the Electricity Building and part in Vincennes. The Triumph exhibit is of motors which run the woodworking machinery shown by the Fay & Egan Company. Among the other exhibits in the Electricity Building the visitor sees the switchboard appliances and overhead line material of the A. & J. M. Anderson Company, the commutator bars of the Billings & Spencer Company, the Van Wagoner & Williams Hardware Company, the Eureka Tempered Copper Works and the Forest City Electrical Company, the fuses of the Chase-Shawmut Company, the switchboard appliances of the Crouse-Hinds Company, the General Equipment Company, Zindars & Hunt and the Cutter Electric Manufacturing Company, the trolley appliances of the Central Union Brass Company, graphite brushes made by Joseph Dixon, Jersey City, N. J., specialties of the Creaghead Engineering Company, switches of the Falk Company, lightning arresters of the Garton-Daniels Company, fuses, overhead line appliances and heaters of the H. W. Johns Company, insulators of Fred. M. Locke, mica and micanite made by Eugene Munsell & Company, brushes of the Ohio Electric Specialty Company, New Process Rawhide pinions, fans of D. L. Bates & Brother, carbon brushes made by the Speer Carbon Company and the Partridge Carbon Company, raw hide pinions of Horsburgh & Scott, conduits of the Sprague Electric Company and American Vitrified Conduit Company, mica of the W. H. Sills Mica Company, Ward Leonard controllers, motors of the Jeffrey Manufacturing Company and the Crocker-Wheeler Electric Company, and wire of the Hazard Manufacturing Company and the Okonite Company.

In Class 27 of miscellaneous exhibits, in Electricity Building, are shown electric heaters made by the Consolidated Car Heating Company, Gold Car Heating Company and the American Electric Heating Corporation, and the measuring instruments of the Bristol Company, the Weston Electrical Instrument Company and Queen & Company.

Many of the American exhibitors in the tramway department have limited themselves to photographs or drawings of the apparatus made by them. This is particularly the case with the E. P. Allis Company, the American Car Sprinkler Company, the American Car Company, Babcock & Wilcox, Berlin Iron Bridge Company, Harold P. Brown, Chisholm & Moore Manufacturing Company, Christensen Engineering Company, Consolidated Car Fender Company, Hipwood-Barrett Car & Vehicle Fender Company, Leonhardt Wagon Manufacturing Company, Link Belt Engineering Company, J. R. McCardell Company, New York Car Wheel Works and Taunton Locomotive Manufacturing Company. Others, however, show models of their apparatus or samples. Among these, American rail-joints of different kinds are particularly prominent, especially those of the Continuous Rail Joint Company, the Weber Railway Joint Manufacturing Company and the Diamond State Steel Company. The Charles Scott Spring Company and the A. French Spring

Company both show sets of locomotive springs, while the Peckham Truck Company exhibits a beautiful set of models of the different types of Peckham truck. The American Street Railway Association has on exhibition a complete file of its transactions. McKee, Fuller & Company show a set of car wheels and axles, the Pressed Steel Car Company shows samples of its cars, trucks and bolsters, the Q. & C. Company of its tie plates, and the Safety Car Heating & Lighting Company is exhibiting its method of gas lighting.

Group IV. at the Paris Exposition comprises machinery, and, as is well known, the American exhibits in this department attracted widespread attention abroad, owing to the handsome showing made by American manufacturers. In this group are included steam appliances, prominent among which are engines of the E. P. Allis Company and of the Ball Engine Company, boilers of the Babcock & Wilcox Company and of the Clonbrock Steam Boiler Company, valves and pressure gages of the Crosby Steam Gage & Valve Company, injectors of the American Injector Company and Penberthy Injector Company, purifiers and filters of the Burt Manufacturing Company, steam separators of Joseph De-Rycke, lubricating graphite of the Joseph Dixon Crucible Company, governing and reducing valves of the Locke Regulating Company, valves, gages, injectors and lubricating devices of the Lunkenheimer Company, a feed-water heater of the Taunton Locomotive Manufacturing Company, valves, piping, etc., of the Walworth Manufacturing Company and of the Crane Company, feed-water heaters, pumps and condensers of the Wheeler Condenser & Engineering Company, pressure gages of the Bristol Company, valves and pumps of the Chapman Valve Manufacturing Company, a portable, automatic air compressor of the Christensen Engineering Company, conveying machinery of the Jeffrey Manufacturing Company, pumps and condensers of the Stilwell-Bierce & Smith-Vaile Company, flexible shaft appliances of the Stowe Manufacturing Company, exhaust fans and blowers of B. F. Sturtevant & Company, hydraulic jacks of the Watson-Stillman Company, pneumatic tools of the Chicago Pneumatic Tool Company and of the Q. & C. Company, corundum wheels of the Hamden Corundum Wheel Company, and machine tools of the Niles Tool Works Company and the Pond Machine Tool Company.

One of the most prominent electric railway exhibits at the Paris Exposition is the large electric locomotive, manufactured by the Allgemeine Elektricitäts Gesellschaft, of Berlin, and designed for hauling passengers and freight cars, as well as for switching purposes on heavy-service roads. It is constructed for a standard gage of 4 ft. 8½ ins. (1435 mm). The trolley and fixtures above the locomotive may be removed without trouble in case it is desired to use the locomotive as a car of a train. In that case the gears are also removed from the axles, so that the armatures do not revolve. The locomotive is capable of pulling a 300-ton train at a speed of 19 miles an hour, or 30 km per hour, on a level. The weight available for traction, which is equal to the total weight of the locomotive, is 24 tons; the maximum draw-bar pull at the start is 7900 lbs. (3600 kg). With the exception of the roof of the motorman's cab, the floor and the inner facing, the locomotive is constructed entirely of iron and steel. The wheel base is 8 ft. 2½ ins. (2500 mm), so that the locomotive can traverse the sharpest curves met with on railways. The wheels are 39.4 ins. (1000 mm) in diameter, and have wrought iron centers, with steel tires. The weight of the locomotive is carried on the two axles by means of elliptical springs.

The locomotive is equipped with a Westinghouse air brake, with independent motor compressor, and with hand brakes. Air whistles are used. The front and rear of the locomotives are made low, with sloping tops, to give an unobstructed view of the track from the cab, according to standard practice.

The trolley base extends along the entire length of the roof of the cab. The current is taken off by means of four sliding trolleys of special construction, which are pressed against the trolley wires by means of heavy springs. The style of trolley was adopted on account of the frequent changes of direction of travel which might be expected. In order to insure sufficient contact the manufacturers recommend a number of No. 0 (8 mm) trolley wires. The locomotive at Paris is fitted with three.

The locomotive is equipped with two type 800 V. B. (150 hp) motors, each geared to an axle at a 1 to 3 ratio.

In addition, this German company has on exhibition a three-phase 3000-kw generator with direct-coupled exciter, a pavilion lighted by Nernst lamps, a complete assortment of commutators, transformers, wattmeters, arc lamps, tramway equipment parts, photographs of installations, etc.

The German exhibits, on the whole, are exceedingly complete and elaborate, and reflect great credit on the German manufacturer. Among those which I have not previously described the exhibit of Felten & Guilleaume, of Carlswerk, deserves notice. In addition to the full line of bare and insulated wires, which this company shows, for electric light, power and miscellaneous electric service, the company is making quite an elaborate exhibit of copper rail-bonds. Both the Electricitäts Actiengesellschaft, formerly Schuckert & Company, of Nuremburg, and the Helios Company, of Cologne, make elaborate exhibits. The latter shows quite an amount of tramway apparatus including railway motors of different sizes. Outside of Germany, the principal Continental firms exhibiting tramway apparatus are Ganz & Company, of Buda-Pest, and the Société Anonyme d'Electricité & Hydraulique, of Charlevoix, both of whom have elaborate exhibits. The latter shows direct-connected units of 1000-hp three-phase, 500-hp monophase, 200-hp direct-current motors, etc., in addition to its standard street railway equipment.

Most of the English exhibits which are of interest to tramway managers will be found in the Electricity Building, although there are a few in Vincennes. Among the latter are the Westinghouse exhibits, already mentioned in previous issues. The Mossberg Roller Bearings Company shows journals fitted with its well known bearings. In the Electricity Building, however, will be found the greater part of the British exhibits, including those of the British Insulated Wire Company, Callender's Cable & Construction Company and W. T. Glover, showing cables and wires for electrical transmission purposes. British industries are also well represented by the exhibit of Mather & Platt, who have a direct-current unit in the Exposition power station; the Chloride Electrical Storage Syndicate and the Electrical Power Storage Company both showing accumulators, and James White, of Glasgow, who is exhibiting a fine line of scientific and measuring instruments. R. W. Blackwell & Company, Ltd., also exhibit a full line of the many devices and appliances for which they are selling agents, and supplied a large proportion of the material for the third-rail Exposition Railway. In the Suffren power station of the Exposition one of the largest engines was supplied by Willans & Robinson. This engine is of the well-known Willans type, is of 2400 rated hp, and is direct connected to a 1340-kw direct-current 500-volt generator, built by Siemens Bros. With the possible exception of one German engine, which is of about equal capacity, it is the largest engine in either of the two electrical stations at the Exposition.

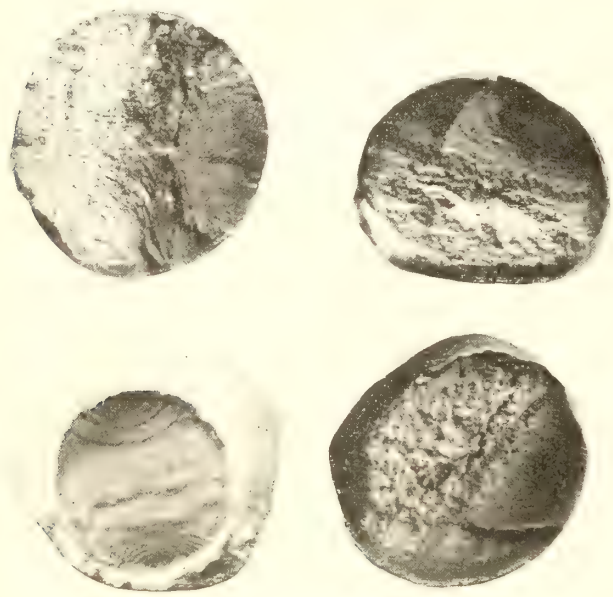
CORRESPONDENCE

Breaking of Copper Trolley Wire

Societa Generale Italiana Edison di Elettricita,
Milan, Italy, July 11, 1900.

Editors Street Railway Journal:

Where the copper trolley wire on our system has broken we have noticed the constancy of certain marked characteristics that we think may be of some interest to your readers. The broken surface is never homogeneous, but consists of one part showing a fresh break, and one or two other parts showing a series of concentric zones of brown



SECTIONS OF TROLLEY WIRE

(Enlarged about five times actual size)

oxide. The photographs annexed represent some of these surfaces.

It would seem from these sections that the breaking is not due to a sudden strain or to a reduction of the area, but occurs gradually and during a comparatively long space of time.

It would be interesting to know if other observations of this kind have been made on other roads, and if any investigations have been made to determine the cause of this initial weakening of the wire. Guido Semenza.

Polyphase Distribution for Electric Railways

Denver, Col., Aug. 10, 1900.

Editors Street Railway Journal:

Dr. Louis Bell has, in this month's Street Railway Journal, what appears to me to be a very timely word of caution against the extravagant application of the three-phase method of distribution for railways. To be in fashion some railway companies are evidently using it when the ordinary well known and much cheaper methods are available. Electrical distribution for railways with direct current and the ordinary standard machinery has by no means reached its limit, and although railway companies are generally suffering for higher voltage, their engineers appear to have overlooked the fact that they all have it within easy reach.

The present and almost universally used method of distribution *is all wrong*. High voltage in the congested districts and low in the suburbs is the rule. It should be the reverse. Running motors down town in series is poor practice. It heats them, while running the cars in the suburbs under low voltage is very expensive. The heavy current used also heats the motors and is a severe drain on the supply. The time of the motorman and conductor is also squandered wastefully. On more than one road with which I am acquainted the total operating expenses could readily be reduced 20 per cent by changes in the circuit arrangements. The method I advocate is a three-wire compensating system. The ordinary generators are used, but coupled in Edison's three-wire way. Those on one side, which are to supply the congested districts, are arranged for, say 450 volts, while the other side, which supply the outskirts, are arranged for, say 650 volts. Such an arrangement would effect a great saving in copper and would come pretty near eliminating that great source of trouble—electrolysis. By speeding up in the suburbs four cars may take the place of five now running, and in some cases one-half of the number could be dispensed with. People living in the outskirts would probably be as well accommodated with a forty-minute service done in twenty minutes as with a half-hourly service, which requires thirty minutes to take them to business or home.

If it is desired to extend the roads to other towns, for instance, the ordinary motors may be used safely and have all of the advantages of a distribution at 1100 volts. This would require a double trolley, each to be in connection with the outside terminals of the three-wire system. The motors would be run in series. John C. Henry.

The Characteristics of a Successful Street Railway Manager

Neck o'Woods, N. Y., Aug. 11, 1900.

Editors Street Railway Journal:

I know that it is great temerity on my part to try to add to the words of yourself, Mr. Vreeland and John Smith, but "fools rush in, etc.," and this is my rush. I read your article on "Successful Managers" in the June number, because I always find something good in that department; I read Mr. Vreeland's article because he always says something worth listening to and has the happy faculty of winnowing the wheat from the chaff and baking it into good, plain, everyday bread (I hasten to say that this last sentence has no reference to *your* article!), and I read Mr. Smith's article because he seems to voice the opinions of that large portion of the human race that bears the same name, and therefore his article *ought* to carry weight.

When I had read and digested the three, I put all the qualifications into one pan of a scale and jumped into the other pan myself, and—like Mr. Smith—I *just* balanced them! That showed at once that there was something wrong somewhere, as I am *not* a "successful" manager; there was certainly short weight or count on the part of the qualifications, so I hunted for the missing ones, and found them as Paddy found the cellar door—"by their *not* being there."

You have all three missed two important qualifications of a "successful" manager—the available opportunity to display his ability and the power to grasp it. You see, it is not given to all of us to have the opportunity to take our little candle out from under the bushel and wave it in the sight of bankers and syndicates; with some of us blind fate sits on top of the basket with all her heft, and our little taper burns on—and out—in "innocuous desuetude"; then again there are times when she will kick the bushel over, yank out the light and wave it so high and wide that all plutocracy shall see it—and thus is made another success-

ful manager! No—the most important of the qualifications is the opportunity—the available opportunity. Shorn of this, the manager may be *capable*, but he will not be "successful" in the full meaning of the term. He may be all that you three artists have painted him; he may be capable in each and every one of the seven ways (Mr. Smith seems to think that there are only six), he may have proved those qualifications one by one and over and over, but until he gets the *opportunity* to *display* those seven managerial virtues, what shall it profit him? And Echo answers: "From twelve to eighteen hundred per year with a week's vacation to attend the A. S. R. A. convention, if it happens to be held near his town"! And Mr. Smith indorses every word that Echo says, and to prove it plays a sample tune on his own horn! This is a bad example, and—while I know that "comparisons are odious"—I am going to do the same thing—in another key.

You—Mr. Editor—have known me a long time and are pretty well acquainted with my railway career; you know that I have had a succession of small successes without a single failure to mar the dread monotony since my unhappy fate dumped me into the street railway business. You know that I can plead guilty to all of Mr. Vreeland's "seven virtues," even to "honesty," "diplomacy" and "horse sense"; you know that I know the street railway business from top to bottom and am still willing to learn, and yet I would hardly call myself a "successful" manager, because I have never had the opportunity to display these qualifications in any field large enough to attract attention to my work nor to redound very greatly to my credit or my financial benefit.

Now, I know that someone will say "Pshaw! The successful man—or manager—*makes* his opportunity." That is not true, and what is worse, it is not good sense. Opportunities are like poets, they are born and not made. It takes three things to make a successful manager; the capable man, the available opportunity and the ability to grasp it, and if they do not all come—and come together at the same time—well, there is "another good man gone wrong"!

So, Mr. Editor, if you do not feel convinced that I am right in both my arguments and my "terrible example," just you get some of those bankers and syndicates to turn loose a few fine, large opportunities and send them down this way, and I will soon prove to you and Mr. Vreeland (Mr. Smith does not need any proof on this point) that you both left out two very important qualifications!

Yours hopefully

BROWN, JONES AND ROBINSON.

The Car Hour Unit in Milwaukee

It will be remembered that at the last convention of the Street Railway Accountants' Association of America, H. C. Mackay, auditor of the Milwaukee Electric Railway & Light Company, made an able argument in favor of the use of the "car hour" instead of the "car mile" as a unit for comparing the results of operation. The "car hour" unit has also the indorsement of John I. Beggs, general manager of the company, and has been adopted by the company, as shown by the reproduction herewith of the company's daily earnings sheet. In this sheet the names of several of the divisions have been omitted to reduce the space required for the form.

This statement, as will be seen, gives a comparison of earnings by lines, together with a comparison of the service given to secure such earnings, and the effect of that service, and keeps the management thoroughly posted as to the service required.

An example is given in the form below, showing an increase in service of forty-five car hours, which has produced an excess revenue of $54. It has, however, reduced

THE MILWAUKEE ELECTRIC RAILWAY AND LIGHT COMPANY

Report of Passenger Earnings

For _____ } _____

Tickets Collected,
25 for $1,00
6 for .25

Comparison Made with Same Day of the Week	Car Hours		Earnings				
			Car Hour				
	1900	1899	1900	1899	1900	1899	Increase or Decrease
Wells St.,—Farwell Av	450	405	2.10	3.20	945.00	891.00	54.00
Fond du Lac Av.,—National Av							
Walnut St.,—National Av							
Sixth Av.,—Third St							
Greenfield Av.,—Third St							
Oakland Av.,—Russell Av							
Holton St.,—Mitchell St							
Muskego Av.,—Eighth St							
Clybourn St.,—Grand Av							
Private Cars							
Miscellaneous							
Total							

Year	Comparison Made With Current Date	Mileage			Earnings		
		Day	Month to Date	Year to Date	Car Hour	Month to Date	Year to Date
1900							
1899							
Increase or Decrease							

MILWAUKEE LIGHT, HEAT AND TRACTION COMPANY

Comparison Made with Same Day of the Week	Car Hours		Earnings				
			Car Hour				
	1900	1899	1900	1899	1900	1899	Increase or Decrease
West Park,—Wauwatosa							
Hawley Road,—N. Greenfield							
N. Greenfield,—Waukesha							
Racine,—Kenosha							
Kenosha City							
N. Milwaukee							
S. Milwaukee,—Racine							
Private Cars							
Miscellaneous							
Total							

Year	Comparison Made With Current Date	Mileage			Earnings		
		Day	Month to Date	Year to Date	Car Hour	Month to Date	Year to Date
1900							
1899							
Increase or Decrease							

the earnings per car hour from $2.20 to $2.10. Assuming the cost of operation to be $1.20 per hour, the result would be:

Year	Car Hours	Net Earnings
1900	450	$405.00
1899	405	405.00

Indicating that while the increased service has reduced the earnings per hour, the profit on the increased hours has made the net earnings equal.

Electric Express Company at Dayton

The Southern Ohio Express & Freight Company is now being organized at Dayton, Ohio, for the purpose of conducting the freight and express business on the electric lines centering at Dayton. The officials of the different electric railways centering at Dayton will be interested in the company, and it is said that James M. Randall, at present with Wells, Fargo & Company, will be general manager of the company. The capital stock of the company will be $100,000.

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Papers and correspondence on all subjects of practical interest to our readers are cordially invited. Our columns are always open for the discussion of problems of operation, construction, engineering, accounting, finance and invention.

Special effort will be made to answer promptly, and without charge, any reasonable request for information which may be received from our readers and advertisers, answers being given through the columns of the Journal *when of general interest, otherwise by letter.*

Street railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our news columns.

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Experience from visiting a large number of railway systems has shown that a pretty fair index of the care exercised in the maintenance of the entire road can be gained from the condition of the car house. While this is not always true, it is generally safe to conclude that where the car house is kept clean and light, and where the corners are not made the depository of worn-out parts and scrap, the line, as a whole, is kept in pretty fair condition. On the other hand, if the reverse is the case, slackness in management is generally present in other parts of the system. This is true not only because one part of the system is not likely to be better than the rest, but because the car house is to a certain extent the center of the maintenance department, and the microbes of trouble which develop outside on the road very often have their origin there. For instance, if a slovenly use of grease is permitted in the car house the repair men there soon look more like coal heavers than like mechanics, whose business it is to handle electrical machinery, and it is not strange if they should lack a certain pride in the maintenance in a cleanly condition of the apparatus under their care. Again, if dust and dirt are allowed to accumulate in the corners, they soon extend to the controllers and motors, and where there are miscellaneous piles of scrap and broken parts on the floor they often hide new supply parts and the tools used in car repairs. As a result the workman fails to find the tool he requires for the repair which he wishes to make, and often either neglects to make the repair entirely or uses an inferior substitute for the right article to save time. The ideal car house should not only be kept in good condition, but it should be so located that there is plenty of light from above and on the sides, and the light should enter the building in such a way that it is not cut off by a line of cars standing on the tracks. Where the structure is in the center of a crowded city, where natural light is not available, it is the best economy to use artificial illumination freely, as it is almost impossible to keep a dark car house in tidy condition. Eternal vigilance is the price of a low maintenance account, and a car house in good order is one of the most important factors in securing it.

* * * *

Another factor, however, is order and arrangement in the repair shop, and here also can often be found causes for a high repair bill. One of the most conspicuous of these causes is that there is no one person responsible for the tools used and there is no place to keep them when not in service. The time lost by workmen in searching for misplaced or lost tools will usually more than pay for a tool room and attendance to insure the return to the storeroom and keeping in proper order of the necessary tools used in repairs. Tools are lost and broken, and in order to save the first cost of the proper tools resort is made to all sorts of makeshifts, which involve loss in labor and the waste of good material. While it is true that a good workman does not blame poor work on the tools he employs, yet it is certain that better work can be produced where well kept tools suitable for their purposes are supplied. The large roads have learned by experience that these elements are vitally important essentials in bringing down the cost of repairs and in increasing the life of the equipment. In the smaller roads these matters are not so readily determined, but the cost of equipment repairs is high, and where the tool investment is small, the supply and labor investment is large for a given number of equipments maintained.

It has been found by several roads operating suburban and interurban lines that the powerful search-light beam from an arc headlight is of great benefit in running the cars at high speeds after dark. Such arcs are always supplied directly from the 500-volt circuits, by far the greater part of the power taken from the line for this purpose being wasted in dead resistance. By the use of the enclosed type of arc lamps from 80 volts to 100 volts can be usefully expended between the carbons. Enclosed arc lamps are

made for even higher voltages, some lamps used on 220-volt lighting circuits being designed to operate with as high as 150 volts or 160 volts between the carbons. It is difficult, however, to adjust the lamps so that they will operate successfully with such long arcs under the vibrations of car service, so that about 100 volts is all that can be usefully expended in the arc, the other 400, 450 or 500 volts, as the case may be, being wasted in the resistance. In an arc taking 6 amps. this means a waste of about 2½ kw or 3 kw, and any means of preventing this waste would remove a serious objection to the arc headlight. While this power can during a part of the year, be used to assist in heating the car by putting the headlight resistance in the car during the winter and outside of it in the summer, obviously the most useful application would be in the lighting of the car, as car lights and headlights are desired at the same time, summer or winter. If the car lights were wired in series with the arc headlight, in place of the usual resistance, they would be subjected to the fluctuations of the arc, and particularly to the jump of the current when the arc is struck by the closing of the carbons together on starting. The fluctuations of the enclosed arc are slight, and their effect upon a circuit with a large fall of voltage in series with the arc is still less, so that this factor would disturb the steadiness of the light of incandescent lamps less than the usual variations of trolley voltage. The jump of the current on striking the arc might, at first sight, appear to be a serious objection, but it must be remembered that even if the arc is short-circuited the lamps, normally burned at 450 volts, would only be getting 550 volts, not enough to burn them out very soon if of good quality and of low efficiency.

About two years ago one of the large Edison companies operating 80-volt enclosed arc lamps on its 115-volt mains tried the experiment of putting in incandescent lamps for the series resistance to absorb the 30 volts or 35 volts difference between the line voltage and that of the arc. These lamps, of course, got a tremendous rise of voltage when the arc was momentarily short-circuited by the closing together of the carbons. They operated satisfactorily, however, for some time; but, being simply used to illuminate a street corner sign, the arc itself giving all the light that was wanted, their value was small and their use was not extended. In street railway work, however, the 2500 watts or 3000 watts thrown away in series with an arc headlight would serve to light thirty or forty 16-cp lamps, enough to make even the longest double-truck car a blaze of illumination. This could be done without taking any current for the incandescent lamps, the waste of the headlight being used solely for this purpose. The wiring could easily be arranged to substitute a resistance for the arc light during those times when it is desirable to shut off the arc on meeting other cars, etc. It would be interesting to know whether this experiment has been tried, and if so, with what results.

Street Railway Consolidation.

Some time since we gave a brief investigation of the advantages to be derived from consolidating small roads into connecting systems, viewing the matter mainly from the operating side. The advantages gained in the way of cheaper motive power, increased traffic from other connections, and the possible advantage to be gained from consolidating power systems—all these causes operate to insure very material economies. There is, however, another side to the matter, viz: The gains to be made from consolidation in the matter of more general expenses than those to which we previously referred. Whatever views may be held with respect to the effect of consolidations broadly considered in the public interest, all political economists seem to be pretty well united for once upon the following proposition: That human energy misapplied, or applied at an economic disadvantage, is a loss to the community. Consequently there seems to be a general concurrence of opinion that as regards consolidations, viewed in their most general aspect, those changes due to consolidation which avoid needless expense and apply, on the whole, the energy of the organization more efficiently thereby, are, to both public and private interests, thoroughly beneficial.

A very brief investigation of the facts regarding the small street railways of the country will show that not only can consolidation improve their condition in the ways heretofore described, but more particularly by means of lessening unnecessary and wasteful expenditures, and enabling the general business of the consolidated companies to be carried on more economcially than would otherwise be the case.

Without endeavoring to analyze too closely the nature of these affairs, there are three directions in which consolidations are able to make a very remarkable improvement in the economic conditions surrounding such enterprises. These three are, economy in fixed charges, economy in administration, and economy in maintenance and repairs. Taking these up in order, an item which is apparent at the first glance is the advantage of large consolidated interests in the matter of funded indebtedness. When a group of roads pools its issues, and comes under a consolidated management, there is, in nearly every case, back of the enterprise financial support of the most solid character. Now, *per se*, such a backing may be no more responsible or of any higher integrity than the interests back of the small individual enterprises; but, nevertheless, it is a fact that the large interests represented in the case of consolidation can and do secure funds at a very materially lower interest rate than could possibly be obtained by the component parts of the enterprise.

There are still a good many small roads whose funded debt bears 6 per cent interest. They may be perfectly solvent and well administered, but under such general conditions that any further issue of bonds, for purposes the most legitimate, would practically have to be made at the same rate. A very large number of roads have of late been able to secure funds at 5 per cent, but below this rate only the biggest and solidest enterprises have, as yet, been able to go. Once let a group of small roads be consolidated or put into a single coherent solidly backed enterprise, and it becomes possible to secure further capital for proper administration, at a rate ½ per cent to 1 per cent better than could possibly be realized by the roads independently.

Now, street railways at the present time are operated on an average margin of profit so small, that saving of interest on funded debt is an advantage not lightly to be put aside. The last report of the Railroad Commissioners of

Massachusetts gives a vast amount of detailed information regarding the financial status of the various roads throughout the State. The average street railway in Massachusetts is, from necessity, rather conservatively capitalized and rather economically managed. Yet the report of the Railroad Commissioners shows that out of 116 companies doing business in the State, only fifty-four last year paid dividends; while the remaining sixty-two, of which thirty-eight had been in operation more than a full year, had paid no dividends whatever. This indicates that not a few roads, even in a time of more than average prosperity, are staggering along under the unpleasant burden of funded indebtedness.

For example, one small road which carried last year more than three-quarters of a million passengers, came out of the game $2.51 to the bad. Even a small saving in interest on its funded debt would have made a much pleasanter looking balance sheet, although it might not, and would not, have justified the payment of a dividend. Another road that shall be nameless here paid a dividend out of a surplus providentially secured the previous year, although it was blessed during the current twelve months with a visible net income of only $152.34. This statement is merely given to indicate that not all even of the fifty-four companies in Massachusetts which paid dividends had actually earned them during the current year. The long and short of it is that the margin of profit is so small in the operation of the average—not the favored—street railway, that the saving to be secured from the better financial standing, which, on the whole, comes from wise consolidation, is really a very valuable asset. The investor has a feeling of security in a carefully consolidated system that he never has with respect to most of the individual parts of which it is composed.

If this were the only gain to be secured by consolidating there might not be, in many cases, sufficient reason for such a step. But in the general administration of small roads there are necessary expenses which may be materially diminished when a group of roads is put under a united management. For instance, the items of superintendence and clerk hire, in other words, the general office expenses, are very materially reduced by a consolidation of management. In many cases the possible saving might only be 1 or 2 per cent of the operating expenses, but, such as it is, the economy is clear gain. With one set of general officers and an economically administered clerical department, a group of roads can generally be assured of enough saving to make a very perceptible change in the balance sheet.

But this is by no means the most important gain in administration which can be thus effected. Two of the items of general expense in street railway operations, not always appreciated by the general public but painfully evident to those in the business, are legal expenses and insurance. A strong consolidation gains in the former item, not only directly, but indirectly, on account of the considerably smaller probability of a certain class of legal actions being brought to a damaging termination. Every one engaged in the business of transportation sooner or later runs across litigious individuals who succeed in making themselves very disagreeable and sometimes very expensive to the enterprise in which he is concerned.

The general legal department can take care of such cases more cheaply and efficiently than is possible in the case of the small individual road, operating only in the district in which the action may chance to be brought. Legal expense is, however, as a rule, not a considerable portion of the operating expenses; although it not infrequently rises to half a per cent or more. A much more serious matter is the insurance, which is more or less involved in the question of legal expense in very many cases, inasmuch as a large part of the insurance expense is due to accident and liability insurance of one kind or another. A glance through the report just referred to shows that it is not uncommon to find as high as 5 or 6 per cent of the total operating expense charged to insurance. This is a very considerable amount and one in which a material saving would be highly desirable. Of course it is an open question as to how far it is economical for street railways to carry all or a part of their legitimate insurance charges, but the policy of at least partial self insurance is one often carried out successfully, and, in the case of large consolidated enterprises, a chance for gain of this kind is much greater than among roads considered individually.

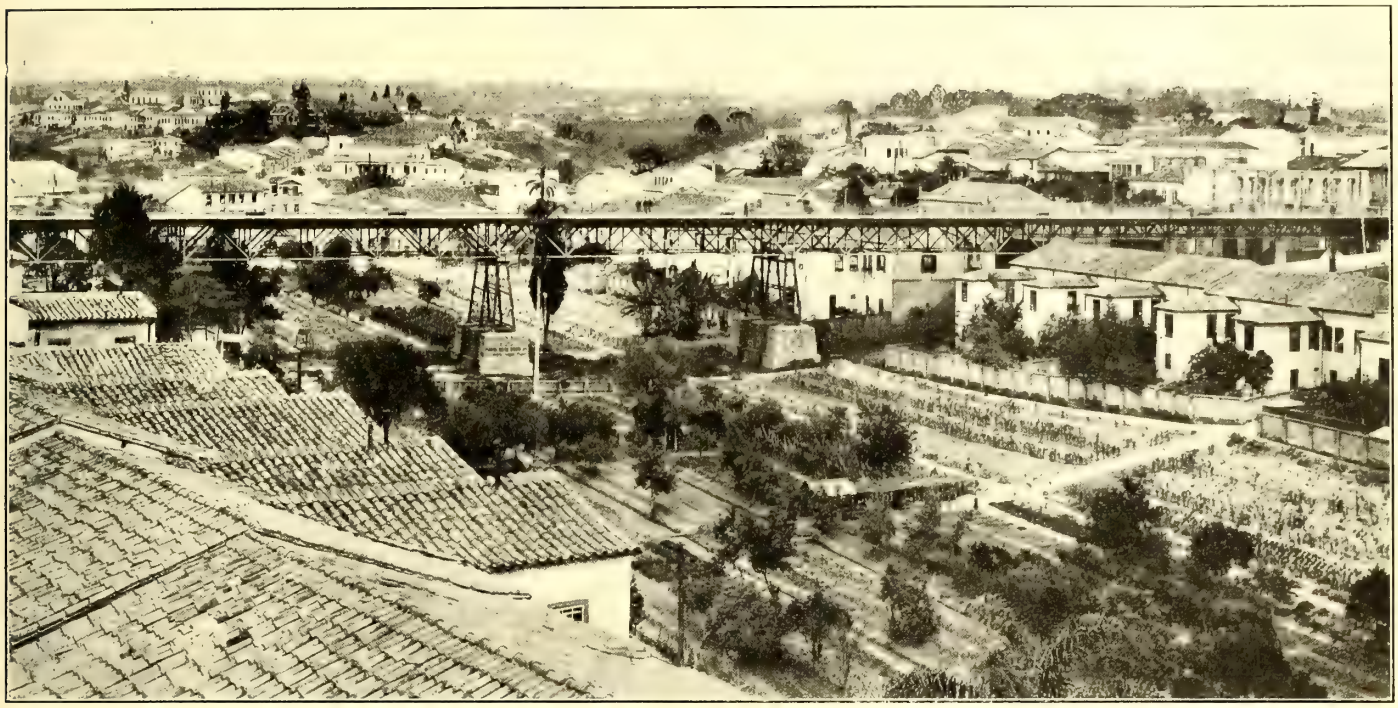
Closely allied to the question of general expense, yet in some features related to operating cost, is the matter of such organization as will secure economical buying, and careful and searching book-keeping. It is rather difficult for a small road in which one or two men are charged with a great variety of duties by way of superintendence, either to keep as close track of the books or to buy as advantageously as is easily possible when there is a regular accounting, auditing and purchasing department. Much of the advantage in consolidation as respects funded indebtedness also applies to the uniting of current purchases of material. On the whole, a large and solidly backed organization can buy cheaper and on better terms, and with more effective competition, than a small road operated as an individual and with comparatively limited resources. It will be very difficult indeed to estimate the amount of possible or probable saving due to this cause, but those practically in the business not infrequently have occasion to realize it.

In the department of operation and maintenance there is likewise a chance for very material economy. As a rule, large roads own and operate their own repair shops, and do much other miscellaneous work of a similar character, for which the necessary equipment is a considerable item of expense. Small roads, as a rule, have not this advantage, and consequently many items of maintenance fall most heavily upon those least able to bear them. The moment a consolidation takes place all the parties to it have the advantage of the aggregated facilities for repairs and maintenance.

The sum total of the items which we have enumerated as favorably affected by a union of roads under a single, strong management, is of amount not easy to estimate exactly on account of the varying conditions. It will generally, however, be as much as 10 per cent of the total operating expense, sometimes as high as 15 per cent. The possible savings from this amount are certainly large enough to make an essential difference in the year's balance sheet of the average road. It is worth noting that the savings here enumerated are practically dependent upon organic consolidation, while those to which we directed attention a few months ago can be, in part at least, secured through friendly affiliation.

The Sao Paulo Tramway, Light and Power Company

In the issue of July, 1899, the STREET RAILWAY JOURNAL announced the formation of the Sao Paulo Tramway, Light & Power Company, Ltd., and gave a short description of its plans. Recent reports from Brazil show that the undertaking is progressing very favorably. This company, it will be remembered, was organized under the laws of the Dominion of Canada, early in the year 1899, for the purpose of constructing and operating a combined electric light, power and street railway system in the city of Sao Paulo, State of Sao Paulo, Brazil, the concessions granted to F. A. Gualco and A. de Souza for these purposes having been assigned to the company. The construction work was commenced about the 1st of July, 1899.



GENERAL VIEW OF SAO PAULO

The city of Sao Paulo has 260,000 inhabitants according to a census just completed. In addition to a large area of the city proper, there are several suburbs to which the company proposes to extend its lines. The city is substantially constructed, possessing many fine buildings, and is well provided with schools for general education, as well as for higher college work, including normal and law schools. The streets are well paved, a very large amount of money having been expended for this purpose within the last few years. A first-class waterworks system supplies all portions of the city, and all sections are well provided with sewers. The city is lighted with gas at the present time, and in a manner fully as satisfactory as that of any city of Europe or in this country, where gas lighting is still in vogue. The street lighting, waterworks and sewers are under the control of the State authorities.

The city of Sao Paulo is located upon a high plateau, about 2300 ft. above the sea level, and on account of climatic conditions, is noted for its healthfulness as compared with other Brazilian cities. The infectious diseases which are so prevalent in the seacoast cities are practically unknown at Sao Paulo, and it is very rare indeed that an isolated case is brought into the city from the seacoast. In consequence of its healthfulness the city of Sao Paulo is the manufacturing center of Southern Brazil, and one of the most important cities in the Republic in this respect. The manufactures are very diversified, consisting of bags, shoes, sugar, beer, cotton and woolen cloths, sacking for coffee bags, flour, brick, tile, coffee, machinery and other products.

A large amount of power is used in the city, now produced by steam, aggregating at least 4000 hp. The power plants are of various sizes, from 500 hp down, of which 1000 hp consists of motors, ranging from 5 hp to 25 hp. On account of the price of coal, the cost of steam power is quite high, and the consumers are very generally pleased at the prospect of securing a cheaper and better form of motive power.

The hydraulic plant is situated at Parnahyba, 21 miles from Sao Paulo, on the River Tiete. The initial installation will consist of three turbines of about 2000-hp capacity, directly connected to alternating-current generators of the three-phase type, with necessary step-up transformers, and high and low-tension switchboards. The building is being constructed so that a fourth turbine and generator can be installed at a later date if desired. As shown by the dotted lines on the general plan of power development the capacity can be doubled should occasion

VIEW OF DAM IN COURSE OF CONSTRUCTION

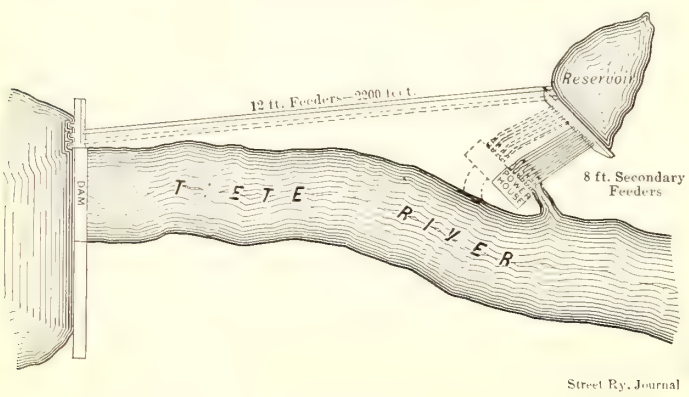
arise. The hydraulic plant consists of two dams, the larger crossing the River Tiete about 35 ft. in the clear height, and about 750 ft. long on the crest, constructed of rubble granite masonry, founded on solid ledge. The illustration shows the dam in course of construction. It will form a large storage reservoir of an average width of 660 ft., and a length of 4 miles to 5 miles in the main course of the river. In addition to this, there are several lateral branches, following up the course of streams emptying into the main river for long distances, and covering large areas, so that the combined surface area of the reservoir will probably exceed 600 acres, thus affording enormous storage capacity. The water will be conveyed from the dam to a small reservoir through a steel tube 12 ft. in diameter, by 2200 ft. in length. This tube will be supported every 10 ft. by steel saddles, similar to the one shown in the illustration. The irregularities in the surface of the ground are overcome by lengthening the uprights of these saddles, and making cuts through the hills. The view of the masonry foundations—which are made of granite rubble, capped with cement—shows the large amount of work required on this main feeder construction. To provide for changes in temperature three expansion joints of the type shown will be placed in this tube. These joints will allow quite a change of length in the pipe, the rubber gaskets effectually preventing leakage. The small reservoir, at a distance of 2200 ft. from the main dam, is formed by a small dam about 165 ft. long by 50 ft. high, across a ravine. The water is led to the turbines from this small dam through steel feeder-tubes, about 8 ft. in diameter and 178 ft. in length. Two small feeders, of about 3 ft. diameter, are provided for operating the exciter turbines. The head of water at the turbines will be about 75 ft.

MASONRY FOUNDATION FOR MAIN FEEDER TUBE

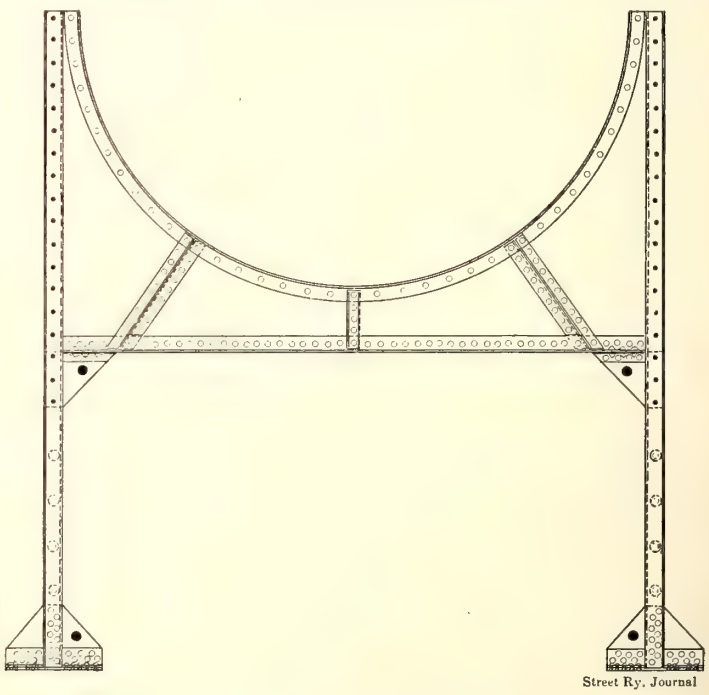
When completed there will be installed in the power house four horizontal twin turbines of a rated capacity of 1800 hp, direct connected to alternating-current generators; and two 150-hp turbines, connected to 100-kw exciters. The hydraulic apparatus is of the Victor type, from the Stilwell-Bierce and Smith-Vaile Company, and the electrical equipment is furnished by the General Electric Company. The alternating current is transformed by twelve step-up transformers of a total maximum capacity of 5600 kw to the line potential of 25,000 volts. The transformers are of the air blast type, the ventilating fans being made by the Buffalo Forge Company. For the operation of the apparatus and the control of the current, an extensive switchboard is provided, consisting of two high-tension line panels, one ground detector panel, four generator panels, two exciter panels, four high-tension and four low-tension transformer panels, and two totalizing panels. In both the main power station at Parnahyba and the sub-station in Sao Paulo the high-tension switchboards are placed on a gallery near the entrance for the transmission line. The other switchboards are placed on the main floor. All high-tension wiring is thus kept away from the low-tension circuits, the latter being, in general, placed under the floor in terra cotta ducts. The power station building is fireproof, built of concrete and iron, provided with traveling cranes, and machine shop for the repair of apparatus.

A substantial and comfortable dwelling house has been constructed, near the power station, for the accommodation of the employees of the company, who are to be stationed at Parnahyba. A telephone system connecting the Parnahyba station with the central one in Sao Paulo, and also connecting the various car houses, shops and offices of the company in the city, will be installed.

From careful measurements of the flow of water made last summer at the low water season, it was found that



GENERAL PLAN OF POWER DEVELOPMENT

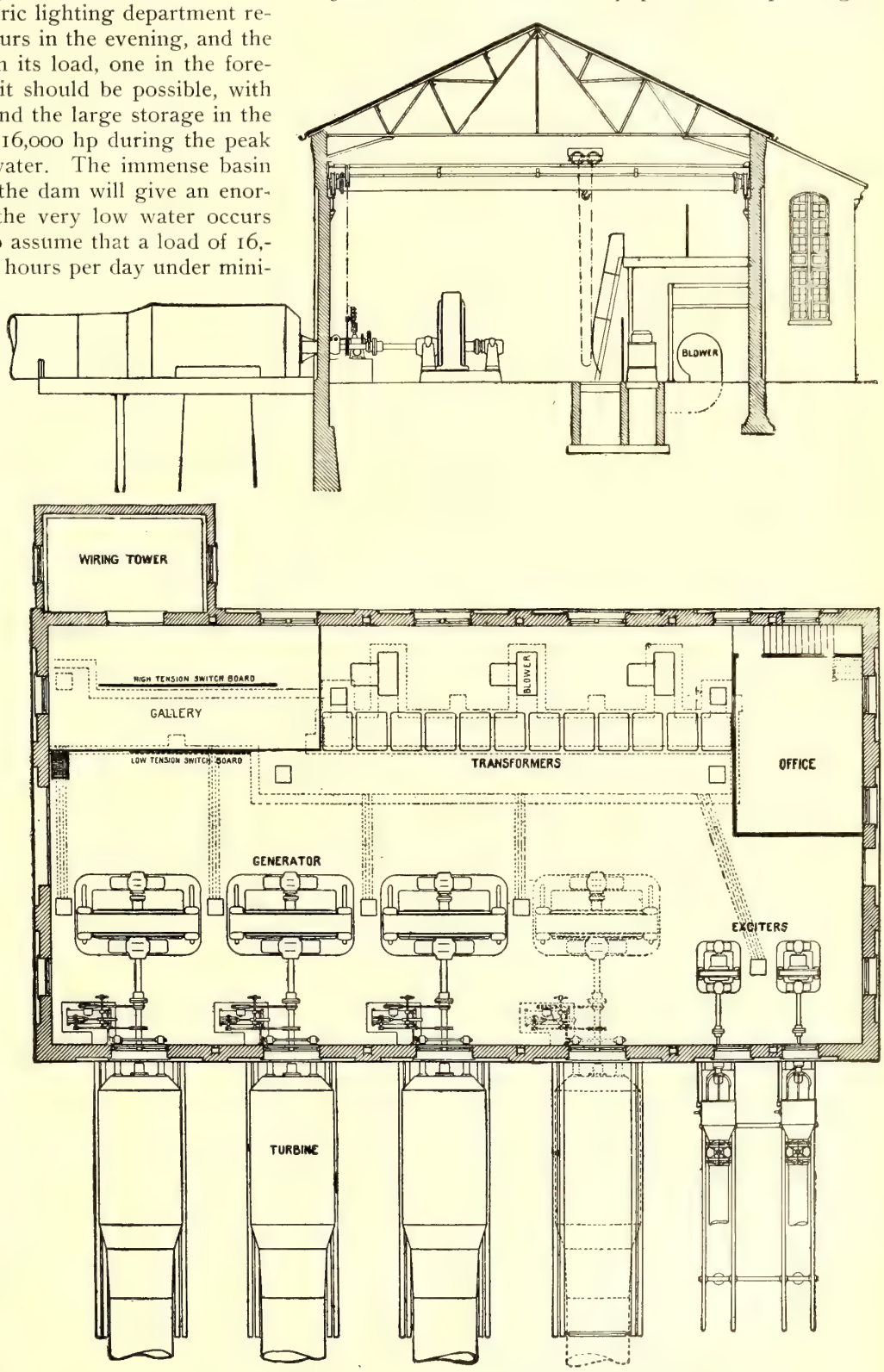


SADDLE FOR SUPPORTING MAIN FEEDER TUBE

there was a minimum of at least 6500 hp flowing through the twenty-four hours of the day. This was based upon accurate measurements, and on an assumption of a much lower water level than was actually found at any time during the summer or as stated by the old residents of Parnahyba. Inasmuch as the electric lighting department requires the power only a few hours in the evening, and the street railway has two peaks in its load, one in the forenoon and one in the evening, it should be possible, with this amount of water flowing and the large storage in the dam, to operate the station at 16,000 hp during the peak of load at the season of low water. The immense basin formed by the construction of the dam will give an enormous storage capacity. As the very low water occurs for a few days only, it is safe to assume that a load of 16,000 hp could be carried for ten hours per day under minimum conditions. With the exception of these few days there will always be at least double this amount, and during the high water season there is at least 140,000 hp available. The rise of water is very gradual, and there are never any sudden freshets in the river; there is also an absence of ice, consequently the troubles and dangers due to cold weather, connected with the operation of the hydraulic plants in the north, are absent. The work on the hydraulic power station is progressing rapidly, and it is hoped that the first power can be obtained from there about the first of next year.

The transmission line from Parnahyba to Sao Paulo will consist of two independent three-phase circuits, designed to operate at 25,000 volts. These circuits consist of No. 0 bare copper wire, and each is of sufficient size to transmit 2200 kw with a loss of about 10 per cent. Octagonal wooden poles are used, 34 ft. long, on which are supported two cross-arms, the braces and other pole fittings being of galvanized iron.

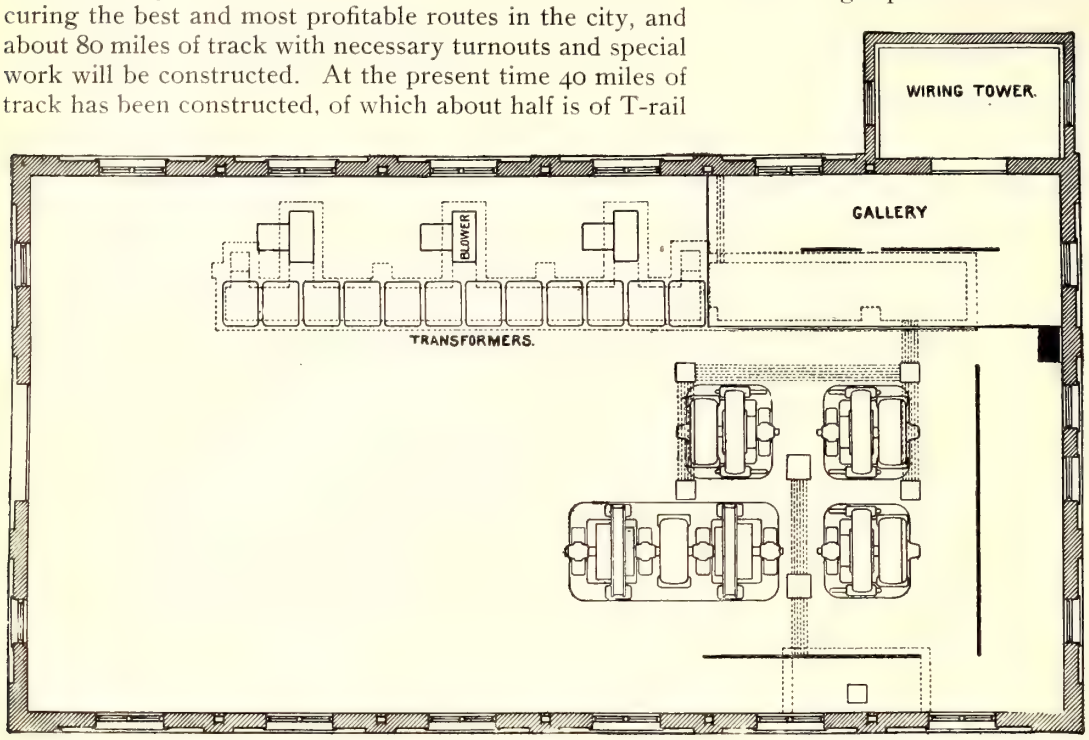
All of the current required for lighting power and street railway purposes will be distributed from a central step-down sub-station, in which the high-tension current at 23,000 volts will be reduced to 2300 volts, and where will also be located motor-generators, for the conversion of the alternating current to a 500-volt direct current for street railway use. This station will consist of a fireproof building, equipped with traveling crane. The electrical installation will consist of three 500-kw induction motors, direct-connected to 575-volt direct-current railway generators, and a synchronous motor set will probably be added. The motor-generators have been used instead of rotary converters, as it is claimed that they will give better regulation on the periodicity adopted, 60 cycles per second. There is also 600 arc lamp capacity of constant current transformers, ten 400-kw potential regulators for lighting circuits, twelve step-down transformers of total maximum capacity of 5600 kw, and switchboard equipments for operating the high and low-tension circuits, and for connecting the electrical apparatus above enumerated. These boards are very complete, and are equipped with the latest type of apparatus, consisting of two high-tension line panels, ground detector panel, four high-tension transformer panels, four low-tension transformer panels, one totalizing lighting panel, four motor panels, four railway generator panels, ten power-circuit panels, arc light circuit



ELEVATION AND PLAN OF POWER HOUSE—PARNAHYBA

panels for twelve 50-light circuits, and ten railway feeder panels.

The railway lines have been laid out with the view of securing the best and most profitable routes in the city, and about 80 miles of track with necessary turnouts and special work will be constructed. At the present time 40 miles of track has been constructed, of which about half is of T-rail and half of girder rail, Pennsylvania Steel Company's sections, No. 242 and No. 243 respectively.



PLAN OF SUB-STATION—SAO PAULO

The girder rail used is 7 ins. high, weighing 90 lbs. per yard, having a lip inside of the groove, which is on the level with the tread of the rail, for the purpose of preserving the pavement. The rails have a 6-in. base, resting on concrete stringers, with steel ties placed 10 ft. apart. These steel ties are made of 7-in. channels, and are 5 ft. 9 ins. long, imbedded in concrete. Drop forged brackets are used, four to each tie, for the purpose of bracing the rail.

STREET SCENE IN SAO PAULO—LAYING TRACK

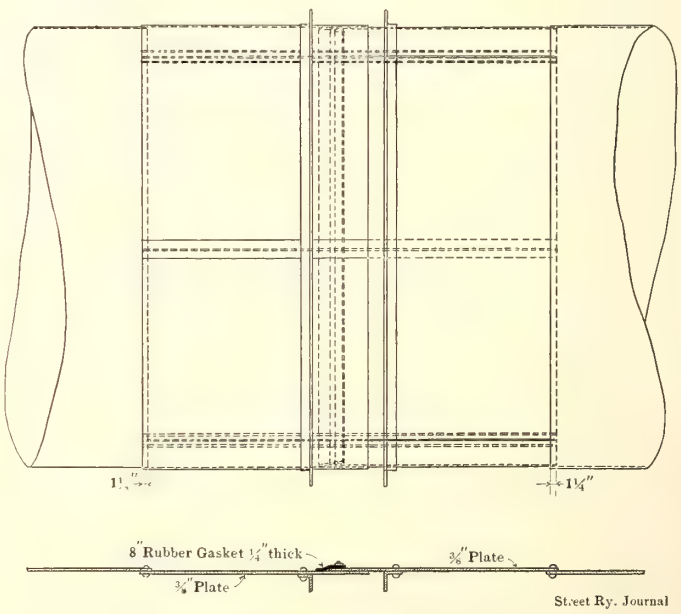
The whole surface is covered over to a distance of 2 ft. outside of each rail with a 4-in. layer of concrete, and to 5 ins. below the tread of the rail to allow for paving blocks. The T rails are 6 ins. high, weighing 62 lbs. per yard. The rails are placed on wooden ties, spaced 2 ft. apart, with four brackets to each tie, through which the rails are spiked to the ties, the whole lying on a layer of concrete 4 ins. thick.

On part of the line steel ties are used in place of the wooden ties. Both the T rail and girder rails are bonded with the West End type of bond.

The single pole overhead construction is illustrated in the engraving. This form is used in many places, but in the center of the city span wires are stretched from poles at the curbs.

The company is operating at the present time fifteen nine-bench open cars of the J. G. Brill Company's make. The cars are 29 ft. 8⅜ ins. in length over the crown pieces, and have a seating capacity of forty-five. They are mounted on Brill 21-E trucks, having a wheel base of 8 ft., and wheels 30 ins. in diameter. The cars are finished in cherry and ash, with a ceiling of three-ply birch veneer, neatly decorated. The cars are equipped with the Neal electric headlights and the Millen illuminated signs. Orders have just been placed with the St. Louis Car Company for fifty additional cars, to be of the same general design and finish as those now in use, and fitted with the same style trucks.

The motor equipments consist of General Electric Type 58 motors. These are rated at 37 hp each, and there are two motors per car.



DETAILS OF EXPANSION JOINT IN MAIN FEEDER TUBE

The electric light system will consist of an underground installation for the center of the city, of a capacity sufficient to supply 10,000 16-cp incandescent lamps and 200 arc lamps. The remainder of the city and the suburbs will be supplied by an overhead system completely covering the entire territory, so that the current can be supplied in any street of the city or suburbs where there is a demand.

On account of the extremely high price of gas, due to the excessive cost of coal, and the great cost of kerosene

oil and other illuminants, the use of electric light will be almost universal, as already indicated by applications to the company, and the electric light system will need to be as extensive and general as the distributing system of a

T RAIL AND CENTER POLE CONSTRUCTION

gas company ordinarily is in a large city. The total capacity of the electric light system in wiring and transformers will be sufficient to supply 50,000 16-cp lamps and 800 arc lamps.

The system of distribution adopted is a single-phase alternating circuit, 2300-volt, 2-wire primary, with a network system of 3-wire secondary mains, at 115 volts. By means of a proper arrangement of feeders and location of transformers, a uniform potential will be maintained in the secondary network. It is proposed to operate from this system all the small motors and fans, for which there is a large demand, as well as to supply current for heating and cooking purposes.

In addition there will be installed a complete system of circuits for power distribution, reaching all sections of the city where power is used. In the central section of the city the motors will be supplied from a three-phase 430-volt underground circuit, the circuit being supplied from transformers situated in the lighting transformer vaults. The remainder of the city will be supplied by a three-phase 2300-volt overhead circuit.

It was very important to commence the operation of the company's lines in Sao Paulo at as early a date as possible, and as the hydraulic plant could not be built within eighteen months, it was deemed best to order a small temporary steam plant for the operation of the first electric lines. This plant, which is now in operation, consists of two 350-hp engines, built by the Robb Engineering Company, of Amherst, N. S., directly connected to 225-kw generators. This plant will operate about twenty cars. As already mentioned, fifteen cars only are now in operation, for which a small car house has been erected.

When the power is supplied by the hydraulic power station at Parnahyba, the cost of operating the tramway lines will be low, as open cars only are required, and there will be no snow expenses, while the wages of all classes of labor are very much lower than the ruling wages in this country. The cost of operating the plant at Parnahyba and the distribution of the current in Sao Paulo for lighting and for manufacturing purposes will also be very low. The men required for the direct operation of the plant will be experienced and well paid, but few of this class are needed, and the great body of employees required for the maintenance of the transmission lines in the city and the general conduct of the business will be of the ordinary laboring classes, so that the cost of producing and distributing the power will be fully as low, and probably less, than with any hydraulic power station in this country. Under these conditions it is believed that the ratio of net to gross income will be very high.

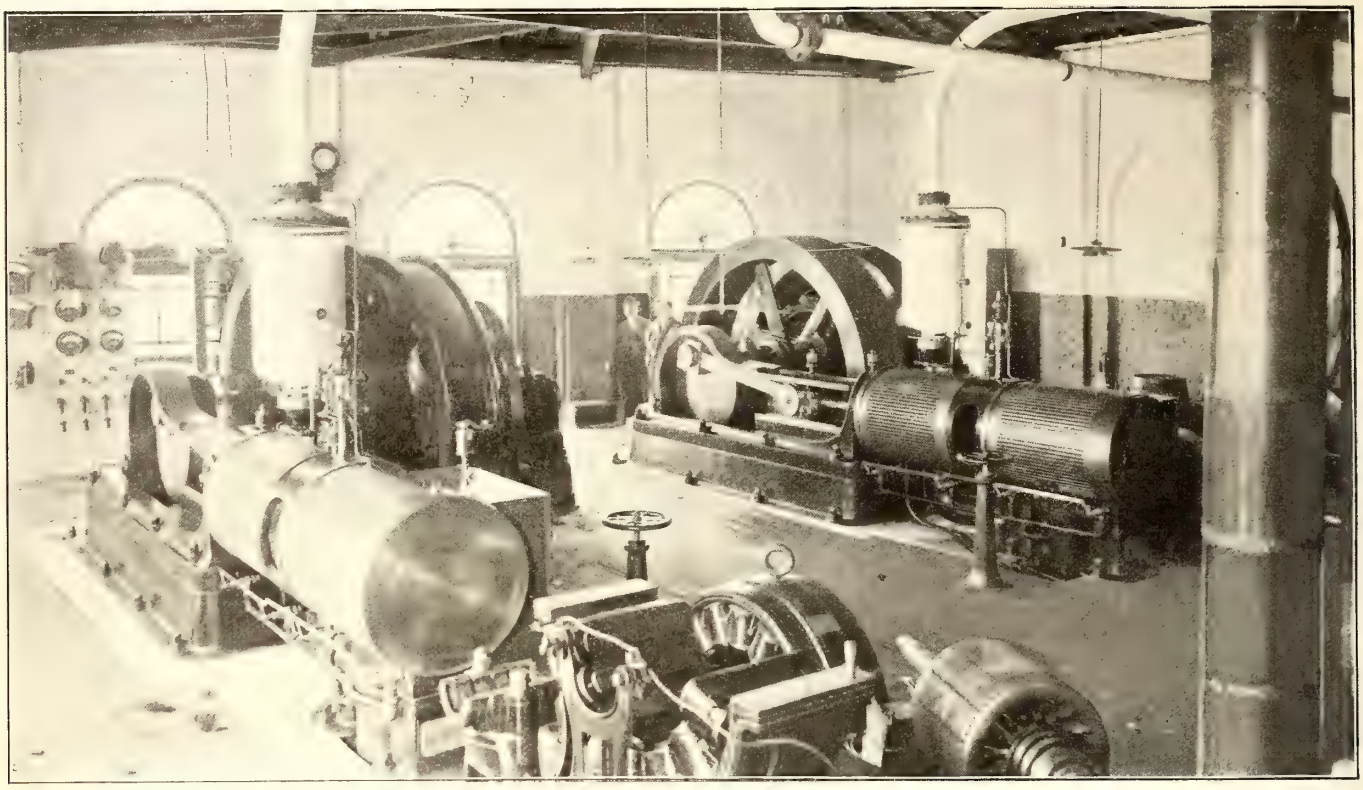
The contracts for the track materials, electrical and hydraulic equipment were placed a year ago at prices much less than those prevailing at the present time, and the cost of construction is being carried out well within the amounts estimated by the company's engineers.

At the time of the organization of the Sao Paulo Company and the commencement of the work there were two rival companies engaged in business in the city, one the Viacao Paulista, with about 57 miles of track, doing a street railway business with animal traction, the other the Agua Luz, operating an electric light business and supplying about 5000 incandescent lamps and 100 arc lamps. Negotiations are under way for the absorption of these two companies by the Sao Paulo Tramway, Light & Power Company, Ltd. The Viacao Paulista owns and operates two independent railway systems, one situated in the city

STREET SCENE IN SAO PAULO, SHOWING ONE OF THE OLD CARS

of Sao Paulo and the other in Santos, a city of 60,000 inhabitants, about 50 miles distant from Sao Paulo, and one of the most important ports in Brazil. The plant and equipment of the Viacao Paulista includes about 57 miles

of track in Sao Paulo, 153 passenger cars, with an average seating capacity of twenty-three, twenty-six freight cars,



INTERIOR OF STEAM POWER STATION, SAO PAULO

two locomotives, 2300 mules, and ten car shops and stables.

The company has in its employ in charge of the work at Parnahyba H. L. Cooper, one of the best known hydraulic engineers in this country. The general business of the company in Brazil is under the charge of Robert C. Brown, formerly electrical engineer of the West End Street Railway, of Boston, afterwards chief engineer of the Montreal Street Railway Company, and later general manager of the Halifax Electric Tramway Company, of Halifax, N. S. A. Mackenzie, of the firm of Blake, Lash & Cassels, of Toronto, is in charge of the legal interests of the company.

Changing the Broadway Road From Cable to Electric Power

The Metropolitan Street Railway Company, of New York, is utilizing the usually slack traffic months of July and August to make the necessary changes in the conduit of the Broadway cable railway to fit it for electric traction. This work is in line with the policy of the company, announced some time ago by President Vreeland, to change over all of its cable lines to the underground trolley system. The work is being carried on in sections of three or four blocks in length, so as not to obstruct the street to any greater extent than is necessary, and a section is completed and paved in before the adjoining section is opened. The reconstruction is being carried on without interfering with the operation of the cable cars, and as these cars run under a thirty-second headway during the greater portion of the day, and as the reconstruction not only involves radical changes in the conduit itself, but renewal of all tie-rods and track rails, it will readily be seen that the task is one of no small engineering difficulty. It is done by keeping the men at work as long as possible between bunches of three or four cars, then having them

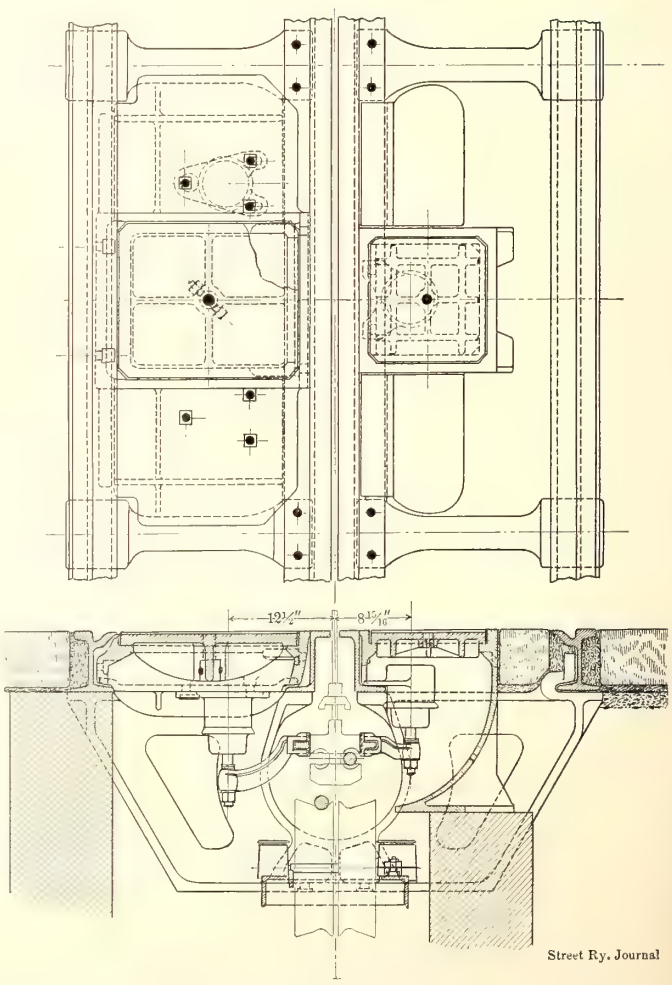
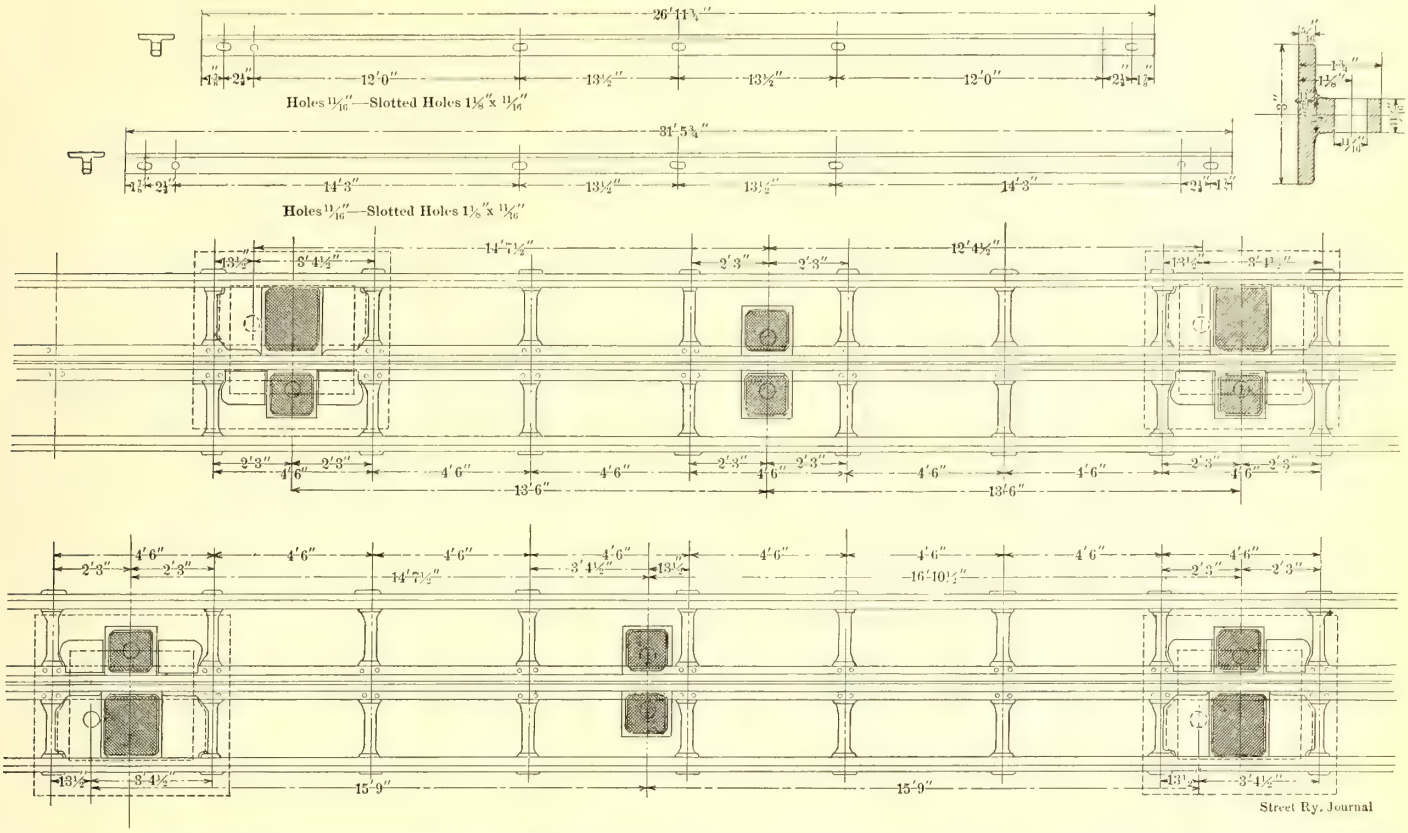


FIG 1.—SECTION AND PLAN, SHOWING BROADWAY CONDUIT, ELECTRICALLY EQUIPPED

suspend operations until these cars have passed, then beginning their work again quickly. Of course at night the headway is much longer, and this allows the men to work under much more advantageous conditions.

The accompanying diagram, Fig. 1, shows a cross sec-

tion and plan of the Broadway conduit, as adapted for electric traction. For convenience of reference the existing cable sheaves and grip are superimposed on the section in light lines in their correct position. In the present work the insulators, brackets and conductors are not being installed, this being left for a later date, when they can be



GENERAL PLAN OF BROADWAY CONDUIT, SHOWING THE TWO STANDARD SPACINGS OF HAND-HOLES, ALSO CONDUCTOR BARS

put in place through the hand-holes and grip hatches without disturbing the pavement.

The principal work now being done on the conduit itself is the cutting of the concrete for, and the setting in place of, the hand-hole curbs. In the original Broadway conduit the yokes were 4 ft. 6 ins. apart, and the carrier pulley vaults were spaced either 27 ft. or 31 ft. 6 ins. apart, depending upon local conditions. As shown in the plan, Fig. 1, which is of the conduit at such a vault, the old manhole cover was on one side of the slot rails only. This cover will not be interfered with, but the insulator for that side of the conduit will be supported on either one side or the other of the cover, depending on the spacing. Directly opposite each of these covers, however, a special hand-hole curb is being installed, as shown. This curb is of cast iron, rests on a concrete base, and is grouted in place. Midway between each manhole, also, similar hand-holes are being installed for insulators, so that the latter will be located either 13 ft. 6 ins. or 15 ft. 9 ins. apart. The original conduit was lined with sheet iron. This necessarily had to be cut away at the hand-holes, but is being left in position between the hand-holes. The form of conductor bars and insulators to be used is the same as on the rest of the system, and is shown in both engravings.

The method to be followed when the insulators and conductors are introduced in the conduit has not yet been announced, and this forms a very interesting problem. As will be seen from the section, if these conductors are placed in position while the cable is in use, the grip will be apt to collide with the conductors, and break the insulators. On the other hand, if cable operation is stopped during the considerably long process of introducing the insulators and conductors, the financial loss, owing to a suspension of traffic, would be considerable. It will be remembered that in the conversion of the Third Avenue Railroad the insulators were mounted on rods, so that they could be slid to the side of the conduit and equipped. When the company was ready to make the change to electricity, the cable was stopped and all the insulators in a section were slid forward into position together, taking a much shorter time than if all the work of placing them in position had to be done when cable operation was suspended. On the other hand the Capital Traction Company, of Washington, D. C., in altering over its Pennsylvania Avenue cable line to electricity, ran horse cars during the interruption.

Street Car Building

(Stephenson Practice)

BY CHARLES HENRY DAVIS, C. E.

VIII.—Assembling—(Continued)

In the August issue of the STREET RAILWAY JOURNAL we gave the details of the roofs for our two standard cars, namely, the Boston (closed) and the Brooklyn (open). Tables Nos. 37 and 38 give respectively the details of platforms for the standard cars, while Plates IX. and X. illustrate the various parts. As in tables Nos. 31, 32, 33, 34, 35 and 36, each distinct part of the platforms is described, giving the material, the general dimensions, how made, on what tools and how assembled, all in consecutive order as each car is built in the shop. In using these tables they are to be read across the page, line by line, as in the case of any book. In column 1 the numerals indicate, in consecutive order, the number of distinctive pieces; where a letter follows the numeral it indicates another operation, but not another distinctive piece. Letters in column 4 are the same abbreviations of woodwork and metal work as used on Plates I. and II. These tables are given on the following pages.

Table No. 37

Detail of Platforms of Boston Closed Car, in the Order of Assembling

(25 ft. Body; Car No. 2; Fig. 3; Plates I. and IX.)

Consecutive Number	Quantity	Name of Piece	Piece Number Plates I. and IX.	Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate IX.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									The various pieces of which the platforms are composed are assembled independently of all others, as was seen to be the case with the roofs, etc., and when completed they are attached to the car. These pieces are —	
166	2	**Crown-pieces** (Fig. 296)	3003	O.	--	----------	--	6 ft. 1¾ in. x 14½ in. x 2¾ in.	Each having :—	
					2	Holes	a	9-16 in. diam.	For platform outer-sill (3001) bolts	Borer
					4	Holes	b	9-16 in. diam.	For platform inner-sill (3002) bolts	Borer
					2	Holes	c	13-16 in. diam.	For dasher short-end-posts (3504)	Borer
					2	Holes	d	13-16 in. diam.	For dasher center-posts (3505)	Borer
					2	Holes	e	13-16 in. diam.	For dasher intermediate-posts (3506) through platform outer-sills	Borer
					1	Hole	f	9-16 in. diam.	For pedal alarm-gong pin (3564)	Borer
					1	Hole	g	7-16 in. diam.	For brake-shaft pawl-pin (3527)	Borer
					1	Hole	h	4 in. x 1⅝ in.	For wiring	Borer
					2	Holes	i	9-16 in. diam.	For bolts for brake-shaft lower-bearing (3517) Fig. 331	Borer
					2	Holes	k	9-16 in. diam.	For bolts for platform step-hanger (3531)	Borer
167	4	**Platform outer-sills** (Fig. 294)	3001	A.	--	----------	--	6 ft. 8 in. x 7½ in. x 3 in.	Each having :—	
					1	Gain	a	10¾ in. x 2¾ in.	For crown-piece to rest on	Band saw or shaper
					2	Chamfers	b	----------	To round off the sharp edges	Chamfering machine
					1	Hole	c	9-16 in. diam.	For 7 in. x ½ in. round-head bolts to secure the crown-piece through holes (a) of the crown-piece	Borer
					1	Hole	d	13-16 in. diam.	For securing crown-piece by means of intermediate-post through hole (e of crown-piece	Borer
					1	Tie-bolt	e	6 in. x ½ in.	To prevent the sill from splitting at (f)	
					2	Holes	g	11-16 in. diam.	On the underside for bolts to secure the sills to the side-sills through holes (m) Fig. 33, Plate IV.	Borer
168	4	**Platform inner-sills** (Fig. 295)	3002	A.	--	----------	--	5 ft. 11 in. x 7 in. x 2¾ in.	Each having :—	
					1	Gain	a	14 in. x 2½ in.	For crown-piece to rest on	Band saw or shaper
					1	Gain	b	4½ in. x ½ in.	For iron buffer. These are on the underside of this part, but not seen	Band saw or shaper
					2	Holes	--	9-16 in. diam.	For 7 in. and 6⅛ in. x ½ in. round-head bolts to secure crown-piece through holes (b) of the crown-piece	Borer
					1	Tie-bolt	c	6 in. x ½ in.	To prevent the sills from splitting at (d)	
					1	Hole	e	13-16 in. diam.	On underside, for bolts to secure the sills to the intermediate cross-sill (6) Fig. 38, Plate IV. (*see Con. No. 6, Table No. 31*), through hole (h)	Borer
					1	Hole	f	13-16 in. diam.	On underside, for bolts to secure the sills to the end-sills (2) through hole (e) Fig. 36, Plate IV. (*See Con. No. 10, Table No. 31.*)	Borer
					2	Chamfers	g	----------	To round off the sharp edges	Chamfering machine
169	8	**Platform flooring-boards** (Figs. 297, 298)	3004	Y. P.	--	----------	--	4 in. wide, 1 in. thick	Having :—	
					2	Gains	a	----------	Next the car body to allow rain water on the platform to fall through to the ground. They are screwed to the sills with 128 No. 12 in. x 1¾ in. steel screws	Shaper
170	4	**Crown-piece corner-irons** (Fig. 307)	3501	W. I.	--	----------	--	17 in. x 2¾ in. x ⅛ in.	Each having :—	
					1	Hole	a	----------	For No. 12 in. x 1½ in. steel screws to secure it to the crown-piece	Power punch
					1	Hole	b	----------	For 2½ in. x ½ in. lag screws to secure it to the crown-piece	Power punch
					4	Holes	k	----------	For bolts, same as shown at (k) Fig. 296, for platform step-hangers	Power punch
171	4	**Dasher short-end-posts** (Fig. 312)	3504	W. I.	-	----------	--	2 ft. 1 1-16 in. x 1½ in. x ⅞ in.	Are now inserted in holes (c) Fig. 296, of the crown-piece, the	
172	4	**Dasher-post washers** (Fig. 317)	3507	C. I.	--	----------	--	3½ in. x 1¼ in.	Being first slipped over the end of the post; they are then tightened up with the flat washer and nut under the crown-piece	
173	4	**Dasher center-posts** (Fig. 313)	3505	W. I.	--	----------	--	2 ft. 8¼ in. x 1½ in. x ⅞ in.	Inserted in holes (d) of the crown-piece, and with	
173a	4	**Dasher-post washers** (Fig. 317)	3507	C. I.	--	----------	--	3½ in. x 1¼ in.	Are tightened up with the flat washer and nut under the crown-piece	
174	4	**Dasher intermediate-posts** (Fig. 314)	3506	W. I.	--	----------	--	2 ft. 8¼ in. x 1½ in. x ⅞ in.	Inserted in holes (e) of the crown-piece, and through holes (d) of the platform outer-sills, and with	
174a	4	**Dasher-post washers** (Fig. 317)	3507	C. I.	--	----------	--	3½ in. x 1¼ in.	Are tightened up with the flat washer and nut under the crown-piece	
175	2	**Dashers** (Fig. 299)	3511	S. S.	--	----------	--	2 ft. 8 in. x 5 ft. 10 in.	No. 14 gage, bent to fit around the crown-piece, to which they are secured with 20 No. 12 x 1 in. blued steel screws through holes (a), they are fastened to the dasher short-end-posts with	
176	12	**Dasher end-posts straps** (Fig. 311)	3508	W. I.	--	----------	--	1 in. wide	Slid over the end-posts and bolted to the dashers through holes (b) with 24 round-head ¼-in. stove bolts	
177	8	**Dasher-post top-clips** (Fig. 315)	3509	W. I.	--	----------	--	1 in. wide	Bolted round the center and intermediate-posts to the dashers through holes (c) with 16 round-head ¼-in. stove bolts	
178	8	**Dasher-post bottom-clips** (Fig. 316)	3510	W. I.	--	----------	--	1 in. wide	Bolted round the center and intermediate-posts to the dashers through holes (d) with 16 round-head ¼-in. stove bolts	
179	2	**Iron-buffers** (Fig. 334)	3530	M. I.	--	----------	--	22 in. x 5 in.	Are now bolted to the crown-piece with two bolts, 4¼ in. x ½ in., and to the crown-piece through the platform inner-sills with 4 bolts, 5¾ in. x ½ in., countersunk round heads, and screwed to the crown-piece through holes (a) with 4 lag screws, 3½ in. x ½ in. The undersides of the platforms now receive 2 coats of lead paint mixed in oil, after which they are attached to the car body, the platform outer-sills being secured with 4 bolts 12½ in. x ⅝ in. and 4 bolts 15¼ in. x ⅝ in. through holes (g) of the outer-sills and the holes (m) of the side-sills, Fig. 33, Plate IV. Further, 4 bolts 16½ in. x ¾ in. and 4 bolts 20 in. x ¾ in. are passed through the holes in	
180	4	**Platform-sill clamps** (Fig. 304)	3502	W. I.	--	----------	--	----------	Which are placed under the part (h) of the outer-sills, then the 16½ in. bolts are passed through holes (d) in the end-sills, and the 20 in. bolts through holes (l) in the side-sills, Fig. 33, Plate IV., and holes (b) in the end-sills, Fig. 36, Plate IV., and are well screwed up	
181	4	**Sill-bolt beveled-washers** (Fig. 305)	3503	C. I.	--	----------	--	----------	Are inserted under the bolt nuts on the sloping underside of the outer-sills to give a firm bearing. The platform inner-sills are then secured with 4 bolts, 9 in. x ¾ in. through holes (e) of the inner-sills and the holes (h) of the intermediate cross-sills, Fig. 38, Plate IV., and 4 bolts, 16½ in. x ¾ in. through holes (f) of the inner-sills, and the holes (e) of the end-sills, Fig. 36, Plate IV., there being used	
181a	4	**Sill-bolt beveled-washers** (Fig. 306)	3503	C. I.	--	----------	--	----------	For the holes (e) of the inner-sills	
									The following are now adjusted and secured, to a large extent in the order given, though for convenience or other reasons this may be sometimes departed from.	

182	8	**Platform step-hangers** (Fig. 308)	3531	S. S.	--		--	3-16 in. thick	In pairs, are now bolted to the platform step-hanger brackets (1512), Fig. 123, Plate V. (*see Con. No. 85, Table No. 33*, with 8 bolts, 1½ in. x ⅜ in., clearly shown in Fig. 351, and to the crown-piece through holes (k), Fig. 296, with 4 6 in. and 4 7 in. x ½ in. bolts. They are further secured with	
183	4	**Platform-step hook-bolts** (Fig. 320)	3531	W. I.	--		--	4 in. x ⅜ in.	Bolted through the platform outer-sills, and hooked to the step-hanger as shown in Fig. 359	
184	4	**Platform-step tread-boards** (Fig. 310)	3005	A.	--		--	2 ft. 8 in. x 12 in. x 1 in.	Bolted to platform step-hangers with 32 countersunk bolts 1½ in. x 5-16 in. through holes (a)	
185	4	**Platform step-fenders** (Fig. 309)	3534	M. I.	--		--	2 ft. 9 in. x 7⅛ in. x 4¾ in. x ¼"	Screwed to the front of the tread-boards and outer-sills with 40 No. 12 x 1 in. steel screws	
186	4	**Platform-step tread-board facing-irons** (Not Ill.)	3533	W. I.	--		--	⅞ in. half-round	Screwed to the front of the tread-boards with 36 No. 14 x 1 in. steel screws	
187	2	**Switch-stick rings** (Fig. 318)	3560	M. I.	--		--		Placed on the left-hand dasher intermediate-posts, resting on the dashers	
188	2	**Trolley-cord rings and snaps** (Fig. 319)	3561-2	M. I.	--		--		Placed on the left-hand dasher center-posts, resting on the dashers	
189	2	**Dasher-rails** (Fig. 302)	3512	W. S.	--		--	5 ft. 5½ in. x 1¼ in. x ⅜ in.	Is adjusted to the dasher-posts by the 4 holes (a) and secured by the nuts shown; there are further in each rail:—	
					5	Holes	b	5-16 in. diam.	For bolts to hold the dasher rail-caps (3513), Fig. 303	Drill press
					2	Holes	c	5-16 in. diam.	For bolts to secure the dasher-rail grab-handle (3514), Fig. 300	Drill press
					2	Holes	d	⅜ in. diam.	For bolts to secure the brake-shaft upper-bearing (3516), Fig. 328	Drill press
190	2	**Dasher-rail caps** (Fig. 303)	3513	Bz.	--		--	5 ft. 7 in x 2 in. x ⅞ in.	Bolted to the dasher rails with 10 square-head bolts, 1¾ in. x ¼ in. through holes (b)	
191	4	**Dasher-rail grab-handles** (Fig. 300)	3514	Bz.	--		--		Adjusted to the dasher intermediate and short end-posts and secured to the dasher-rails with 4 round head bolts, 1 in. x ¼ in., through holes (c) and with the bolts going through holes (b) of the dasher-rail. They are secured to the short end-posts with	
192	4	**Dasher-rail grab-handle nuts** (Fig. 301)	3515	Bz.	--		--		Screwed to the short end posts	
193	--	**Brake-shafts complete** (Fig. 321)	3519	----	--		--		Consisting of:	
193a	2	**Brake-shafts** (Fig. 321)	3520	W. I.	--		--	1½ in. diam.	With	
194	2	**Brake ratchet-handles** (Figs. 321, 322)	3521	Bz.	--		--		In which are	
195	2	**Brake ratchet-handle upper-ratchets** (Fig. 323)	3522	M. I.	--		--		With	
196	2	**Brake ratchet-handle springs** (Fig. 324)	3524	W. S.	--		--		While to the top of the brake-shafts are secured	
197	2	**Brake ratchet-handle lower-ratchets** (Fig. 321)	3521	M. I.	--		--		Which interlock with the upper-ratchets	
198	2	**Brake-shaft upper-bearings** (Fig. 328)	3516	M. I.	--		--		Bolted to dasher-rail through holes (d), Fig. 302, with 4 bolts 1¾ in x 5-16 in.	
199	2	**Brake-shaft lower-bearings** (Fig. 331)	3517	M. I.	--		--		Bolted to the crown-piece through holes (i), Fig. 296, with 4 bolts 14 in. x ½ in.; the cut-outs (e), Fig. 299, at the bottom of the dasher fit round these pieces and also make room for	
200	2	**Brake-shaft ratchets** (Fig. 329)	3525	C. I.	--		--		Fitted tight to the brake-shaft and keyed	
201	2	**Brake-shaft pawls** (Fig. 326)	3526	M. I.	--		--		Are secured to the crown-piece by means of	
202	2	**Brake-shaft pawl-pins** (Fig. 325)	3527	W. I.	--		--		Which are bolted through	
203	2	**Brake-shaft pawl-washers** (Fig. 327)	3528	M. I.	--		--		The brake-shaft pawl and hole (g) in the crown-piece, Fig. 296	
204	2	**Brake-chains** (Fig. 332)	3529	W. I.	--		--	⅜ in., 30 in. long	Are bolted to the brake-shaft through the hole (a) below the ratchet, Fig. 321	
205	2	**Brake-shaft steps** (Fig. 330)	3518	C. I.	--		--		Are bolted later to the drawbar-rest (3007), Fig. 348, through the holes (c) with 4 bolts 3¼ in. x 5-16 in.	
206	--	**Drawbar spring-castings complete** (Fig. 335)	3535	----	--		--		Composed of:—	
206a	2	**Drawbar spring-castings** (Fig. 336)	3536	M. I.	--		--		Bolted under the platform to the platform inner-sills with 4 bolts 9½ in. x ⅝ in. and 8 bolts 9 in. x ⅝ in. through holes (a)	
207	2	**Drawbar springs** (Fig. 339)	3537	W. S.	--		--		Fitting inside the casting, while going through it and the ends of the casting are	
208	2	**Drawbar-heads** (Fig. 341)	3539	M. I.	--		--		Upon which at each end of the springs fit	
209	2	**Drawbar spring-plates** (Figs. 337, 338)	3538	M. I.	--		--		The heads are held in the castings by means of	
210	2	**Drawbar-head keys** (Fig. 335)	3549	W. I.	--		--		Inserted in the end of the heads, through the slot (a), Fig. 341. When the car is to draw a trailer	
211	2	**Drawbar plain radial-bars** (Fig. 349)	3544	W. I.	--		--	4 ft. 2 in x 2¼ in. x 1⅛ in.	Are inserted between the jaws (b) of the head (3589) and secured by	
212	2	**Drawbar coupling-pins** (Fig. 340)	3540	W. I.	--		--		Which are prevented from being jolted out by	
213	2	**Drawbar coupling-pin cotters** (Fig. 335)	3541	W. S.	--		--		Inserted in holes in the pins. To complete the outfit for trailers	
214	1	**Drawbar coupling-link** (Fig. 344)	3546	M. I.	--		--		Is secured by one of its	
215	2	**Drawbar coupling-link pins and chains** (Fig. 344)	3547	W. I.	--		--		To the other end of the drawbar radial-bar (3544), the other end being similarly coupled to the trailing car	
216	1	**Drawbar coupling-link box** (Fig. 343)	3008	W. P.	--		--		For stowing away the coupling-link when not in use, is secured to the underside of the car bottom by	
217	2	**Drawbar coupling-link box-straps** (Fig. 342)	3559	W. I.	--		--		Secured to the link-box with 12 No. 14 x 1 in. steel screws, and to the car bottom with 4 No. 14 x 1¼ in. steel screws	
218	--	**Drawbar supporting-frames complete** (Fig. 359)	----	----	--		--		Composed of	
218a	2	**Drawbar-rests** (Fig. 348)	3007	A.	--		--	6 ft. 0 in. x 3 in. x 1½ in.	With	
219	2	**Drawbar-rest wearing-plates** (Fig. 350)	3550	W. I.	--		--		Screwed to the rests with 20 No. 14 x 1 in. steel screws. To these rests are secured one end of each of the following supporting pieces, the other ends of same being secured to the platform:—	
220	4	**Drawbar-rest hangers** (Fig. 352)	3552	W. I.	--		--	1 ft. 5 in. x 1½ in. x ½ in.	Bolted to the drawbar-rests through holes (b) with 4 bolts, 3¼ in. x ½ in. and to the crown-pieces with 4 bolts 3¾ in. x ½ in. countersunk heads	
221	4	**Drawbar-rest hangers** (Fig. 353)	3552	W. I.	--		--	1 ft. 5½ in. x 1½ in. x ½ in.	Bolted to the drawbar-rests through holes (a) with 4 bolts 3¼ in. x ½ in., and to the crown-pieces with the dasher short-end-posts (3504)	
222	4	**Drawbar-rest braces** (Fig. 358)	3553	W. I.	--		--	1½ in. x ¼ in.	Bolted to the drawbar-rests through holes (b) with the same bolts as used for the hangers, Fig. 352, and to the platform outer-sills with 4 bolts 3¾ in. x ½ in.	
223	20	**Drawbar-rest toe-guards** (Fig. 354)	3554	W. I.	--		--	½ in. diam.	Screwed to the drawbar-rests with 20 No. 12 x 1 in. steel-screws, and to the crown-pieces with 20 No. 12 x 1 in. steel screws	
224	2	**Drawbar-guards** (Fig. 347)	3006	A.	--		--	4 ft. 4 in. x 3 in. x ¾ in.	Bolted to the drawbar-rest hangers, Fig. 352, through holes (a) with 4 bolts, 1½ in. x ⅜ in.	
225	4	**Fender-slides** (Fig. 357)	3555	M. I.	--		--		In pairs, bolted through holes (a) to the drawbar-rest through holes (a) with the same bolts as used for the hangers, Fig. 353, and through holes (b) to the drawbar-rests through holes (e) with 8 bolts, 3¾ in. x 5-16 in.	
226	4	**Fender adjusting brackets** (Fig. 355)	3556	M. I.	--		--		Bolted to the platform-step tread-boards, Fig. 310, through holes (b) with 8 bolts 2 in. x ½ in.	
227	2	**Fender holding-sockets** (Fig. 356)	3557	M. I.	--		--		With	
228	2	**Fender holding-pins** (Fig. 356)	3558	W. I.	--		--		Bolted to the drawbar rests through holes (d) with 4 bolts 2¾ in. x ½ in.	
229	2	**Upper-deck grab-handles** (Fig. 342a)	2504	W. I.	--		--		Seen in Fig. 359, screwed to the upper-deck roof with 4 No. 14 x 1½ in. and 4 No. 12 x 1½ in. steel screws	
230	2	**Pedal alarm-gongs** (Fig. 345)	3563	S.	--		--		With	
231	2	**Pedal alarm-gong castings and hammer** (Fig. 345)	3565	M. I.	--		--		Are secured to the underside of the platform with 2 bolts 5½ in. x ¾ in. and 2 bolts 3⅜ in. x ⅜ in	
232	1	**Pedal alarm-gong pin** (Fig. 346)	3564	W. I.	--		--		Passes through hole (f) in the crown-piece, and is detachable for use on either platform	
233	4	**Platform-gates and fixtures** (Fig. 333)	3566	W. I.	--		--	Wood's make	Screwed to the ends of the car with 12 No. 15 x 1¼ in., 24 No. 16 x 2 in., 8 No. 20 x 2 in. and 8 No. 20 x 1¼ in. steel screws	

Number of Distinctive Pieces	67	(Column 1)
Total Number of Pieces	235	(" 2)
Number of Bolts	244	(" 6 and 10)
Number of Screws, about	372	(" 6 and 10)
Number of Nails	(?)	
Total	851 +	

Nearly all the pieces and means of attachment described in this table can be clearly seen in Figs. 351 and 359. During the erection of the pieces enumerated in this table, work has been progressing in the interior of the car. (*See Table No. 30 and Plate XI.*)

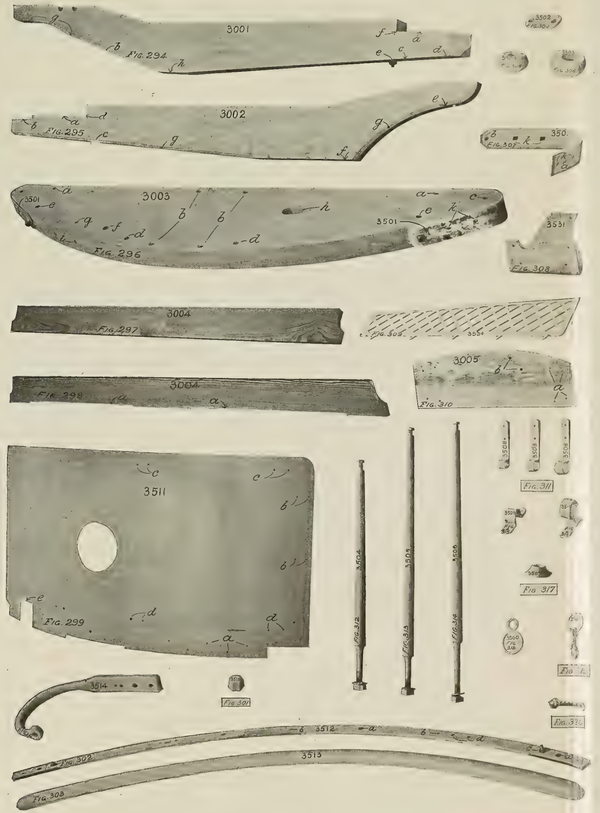
Table No. 38

Detail of Platforms of Brooklyn Open Car, in the Order of Assembling

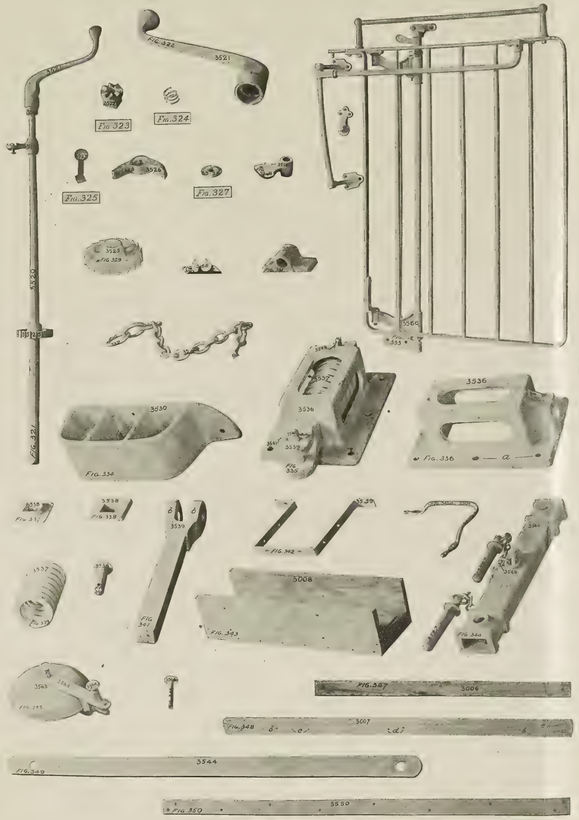
(12 Benches; Car No. 4; Fig. 5; Plates II. and X.)

Consecutive Number	Quantity	Name of Piece	Piece Number Plates II. and X.	Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate X.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
106	4	**Dasher center-posts** (Fig. 363)	8504	W. I.	..	.....	..	41 in. x 1 in.	Are inserted in holes (c) of the crown-piece (5028) Fig. 62, Plate IV., passing through holes (c) of the platform inner-sills (8018) Fig. 61, and bolted underneath	
107	4	**Dasher intermediate-posts** (Fig. 362)	8505	W. I.	..	.....	..	36½ in. x 1 in.	Are inserted in holes (d) of the crown-piece (5028) and bolted underneath	
108	8	**Dasher-post washers** (Figs. 362, 363)	8506	C. I.	..	.....	..	.....	Are passed over the bottom ends of the posts before being inserted in the crown-piece holes	
109	2	**Dashers** (Fig. 360)	8501	S. I.	..	.....	..	No. 16, 6 ft. 6 in. x 2 ft. 8 in.	With hole 9⅝ in. diameter in center for electric headlights, screwed to crown-pieces through holes (■) with 48 No. 12 x 1 in. blued steel screws, round heads	
110	8	**Dasher-post bottom-clips** (Not Ill.)	8509	S. I.	..	.....	..	1⅛ in. wide, ⅛ in. thick	Bolted round the center and intermediate-posts to the dashers through holes (b) with 16 round-head ½ in. x 3-16 in. stove-bolts	
111	2	**Dasher-moldings** (Fig. 383)	8003	A.	..	.....	..	6 ft. 6 in. x 1¼ in. x ⅞ in.	Screwed to dasher through holes (c) with 46 No. 9 x ¾ steel screws	
112	8	**Dasher-post top-clips** (Not Ill.)	8508	S. I.	..	.....	..	1⅛ in. wide, ⅛ in. thick	Bolted round the center and intermediate-posts to the dashers through holes (d) with 16 round-head 1¼ in. x 3-16 in. stove-bolts	
113	4	**Dasher end-moldings** (Not Ill.)	8523	W. I.	..	.....	..	2 ft. 5¾ in. x ¾ in. x ¼ in.	Half-oval, riveted to the end of the dashers through holes (e) with 40 round-head rivets, 7-16 in. x ½ in.; the clips 8508 and 8509 are shown by Figs. 315, 316, Plate IX.	
114	2	**Dasher-rails** (Fig. 382)	8510	W. I.	..	.....	..	1¼ in. x ⅜ in.	Are adjusted to the dasher center and intermediate-posts by the holes (a) and secured by the top nuts shown in Figs. 362, 363. There are further in each rail:—	
					6	Holes	b	.....	For screws to secure the dasher-rail caps (8004) Fig. 384	Drill press
					2	Holes	c	5-16 diam.	For bolts to secure the dasher-post pipe-commode-handle (8514) Fig. 364 to the dasher-rail	Drill press
					1	Hole	d	7-16 diam.	For bolt to secure the brake-shaft upper-bearing (8528) Fig. 371 to the dasher-rail	Power punch
					1	Hole	e	7-16 diam.	For bolt to secure the switch-stick top-holder (8518) Fig. 385 to the dasher-rail	Power punch
					1	Hole	f	⅜ in.	For bolt to secure the fender hold-up eye (8522) Fig. 382, to the dasher rail	Power punch
115	2	**Switch-stick top-holders** (Fig. 385)	8518	M. I.	..	.....	..	.....	Bolted to the dasher-rail through holes (e) with 2 bolts, 1⅜ in. x ⅜ in.	
116	2	**Switch-stick bottom-holders** (Fig. 386)	8519	M. I.	..	.....	..	.....	Bolted to the crown-piece with 4 bolts 3½ in. x ⅜ in.	
117	2	**Fender hold-up eyes** (Fig. 382)	8522	M. I.	..	.....	..	⅜ in. diam.	Bolted to the dasher-rail through holes (f) with 2 stove-bolts, 1⅛ in. x 5-16 in.	
118	4	**Platform-hood supports** (Fig. 361)	8503	W. I.	..	.....	..	1¼ in. diam.	Inserted in holes (e) of the crown-piece (5028) Fig. 62, Plate IV., and bolted underneath	
119	4	**Dasher-post washers** (Fig. 361)	8506	C. I.	..	.....	..	.....	Are passed over the bottom ends of the hood-supports before being inserted in the holes in the crown-piece	
120	4	**Dasher-post pipe commode handles** (Fig. 364)	8514	Bz.	..	.....	..	12 in. long	Are passed over the top of the platform-hood supports, and bolted through holes (a) to the dasher-rail through hole (c) with 4 round-head bolts 1⅛ in. x ½ in.	
121	4	**Platform-hood-support brackets** (Fig. 366)	8515	Bz.	..	.....	..	.....	Are adjusted to the top of the platform-hood supports and screwed to the platform-hood bows with 16 No. 12 x 1¼ in. steel screws	
122	2	**Brake-shaft lower-bearings** (Fig. 369)	8529	M. I.	..	.....	..	.....	Fitted in hole (h) of the crown-piece	
123	..	**Brake-shafts complete** (Fig. 365)	8526	....	..	.....	..	.....	Composed of:—	
123a	2	**Brake-shafts** (Fig. 365)	8527	W. I.	..	.....	..	1 15-16 in. diam.	Are adjusted to	
124	2	**Brake-shaft upper-bearings** (Fig. 371)	8528	M. I.	..	.....	..	.....	Which are bolted to the dasher-rails through holes (d) with 2 bolts 1⅜ in. x ⅜ in. There are also	
125	2	**Brake ratchet-handles** (Figs. 367, 368)	8532	Bz.	..	.....	..	.....	Burns & Silver's pattern with ratchet, Fig. 368, pawl and spring, welded to the top of the brake-shaft	
126	2	**Brake-shaft ratchets** (Fig. 365)	8536	C. I.	..	.....	..	.....	Fitted tight to the brake-shaft and keyed	
127	2	**Brake-shaft pawls** (Fig. 372)	8537	C. I.	..	.....	..	.....	Are secured to the crown-piece by means of	
128	2	**Brake-shaft pawl-sleeves** (Fig. 374)	8540	C. I.	..	.....	..	.....	Upon the upper portion of which the pawl turns, and the lower portion of which is secured to the crown-piece by	
129	2	**Brake-shaft pawl-bolts and nuts** (Fig. 373)	8541	....	..	.....	..	.....	Bolted to the crown-piece	
130	2	**Brake-chains** (Not Ill.)	8542	W. I.	..	.....	..	.....	Are bolted to the brake-shaft below the ratchet	
131	2	**Brake-shaft stays** (Fig. 370)	8531	W. I.	..	.....	..	.....	Bolted to the platform inner-sills (8018) Fig. 61, Plate IV., with 4 bolts 8¼ in. x 7-16 in.	
132	1	**Center-brake-lever carrier** (Fig. 407)	8544	W. I.	..	.....	..	.....	Bolted to the center-brake-lever carrier-beam (5025) Fig. 63, Plate IV., with 4 bolts 8¼ in. x ½ in., round heads	
133	1	**Center-brake-lever** (Fig. 408)	8545	W. I.	..	.....	..	.....	Bolted to the carrier with	
134	1	**Center-brake-lever bolt** (Fig. 406)	8546	W. I.	..	.....	..	.....	And secured with the nut and cotter	
135	1	**Brake-chain connecting-rod** (Not Ill.)	8543	W. I.	..	.....	..	.....	Attached to center-brake-lever and brake-chain	
136	2	**Rigid drawbars** (Fig. 375)	8551	W. I.	..	.....	..	.....	With	
137	2	**Drawbar coupling-pins** (Fig. 377)	8559	W. I.	..	.....	..	.....	Which also passes through hole (c) of the buffer (8590) Fig. 390, and	
138	2	**Drawbar coupling-pin chains and eyes** (Fig. 377)	8561	W. I.	..	.....	..	.....	Bolted to crown-piece through holes (g) with 6 bolts 4¼ in. x ½ in., the eyes being secured with one of the buffer-bolts. (*See Con. No. 140, also Fig. 390*). The bolt also passes through one of the holes (a) of the buffer	
139	4	**Buffer-blocks** (Fig. 379)	8006	A.	..	.....	..	6⅝ in. x 3½ in. x 2¾ in.	And	
	4	**Buffer-blocks** (Fig. 379)	8006	A.	..	.....	.	6⅝ in. x 3¼ in. x 2¾ in.	Screwed to the projecting ends of the platform inner and outer-sills with 8 No. 20 x 4 in. steel screws	
140	2	**Angle-buffers** (Fig. 390)	8590	W. S.	..	.....	..	.....	Bolted through holes (a) to the platform inner and outer-sills through holes (d) and (c) Figs. 60, 61, Plate IV., with 8 bolts, 8 1-16 in. x 7-16 in.; the bolts also pass through the buffer-blocks, and the platform-hood supports pass through holes (b)	
141	4	**King-bolt-casting beams** (Figs. 391, 392)	8010	O.	..	.....	..	3 ft. 9¼ in. x 13¾ in. x 3¼ in.	Of which two are cut out at (d) to make room for the pedal alarm-gong, are bolted to the crown-pieces through holes (f) Fig. 62, Plate IV., with 4 bolts 8 in., 4 bolts 8¼ and 4 bolts 8½ in. x ½ in., countersunk heads	
142	2	**King-bolt bottom-castings** (Fig. 402)	8595	M. I.	..	.....	..	.....	Bolted to the king-bolt casting beams through holes (b) with 8 bolts, 10¾ in. x ½ in., and to the king-bolt-casting beams through holes (c) and the king-bolt beams through holes (f) Fig. 53, Plate IV., with 4 bolts 16¾ in. x ½ in.	
143	2	**King-bolt top-castings** (Fig. 404)	8594	M. I.	..	.....	..	.....	Bolted to the king-bolt beams through holes (d) with 4 bolts 5¼ in. x ⅝ in.	
144	2	**King-bolts** (Fig. 404)	8593	W. S.	..	.....	..	.....	Adjusted to the top and bottom castings	
145	2	**Spring-compressor channels** (Fig. 398)	8599	W. S.	..	.....	..	6 ft. 2½ in. x 6 in.	To which is fitted	
146	2	**Spring-compressor wearing-plate beams** (Fig. 399)	8005	O.	..	.....	..	6 ft. 7 in. x 5½ in. x 3 in.	Both being then bolted together to the side-sills through holes (j) Fig. 48, Plate IV., with 8 bolts 8¼ in. x ⅝ in.	
147	2	**Spring-compressor wear-plates** (Fig. 405)	8600	W. S.	..	.....	..	.....	Screwed to the wearing-plate beams with 28 No. 16 x 2 in. steel screws, countersunk heads	
148	4	**Truck check-chain hooks** (Fig. 403)	8619	W. I.	..	.....	..	.....	Secured with bolts of the spring-compressor wearing plate beams (8005) Con. No. 146	
149	4	**Angle truck-bearing plates** (Fig. 400)	8597	W. S.	..	.....	..	.....	With	

BOSTON CLOSED CAR. (Table No. 37.)



BOSTON CLOSED CAR. (Table No. 37.)



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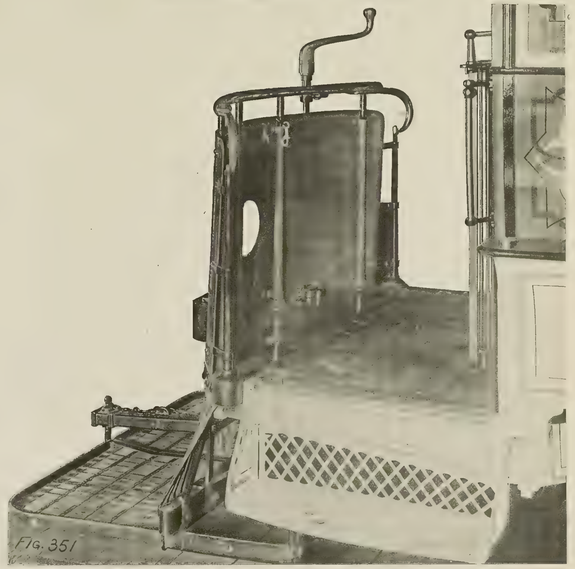


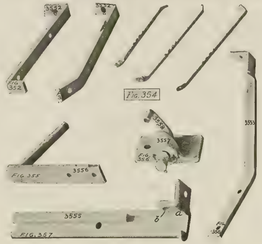


PLATE IX. [Figs. 294 to 359]

DETAILS OF PLATFORMS OF

BOSTON CLOSED STANDARD CAR

BOSTON CLOSED CAR. (Table No. 37.)

ILLUSTRATING

STREET CAR BUILDING

(Stephenson Practice)

By

Charles Henry Davis, C. E.

BROOKLYN OPEN CAR. (Table No. 38.)

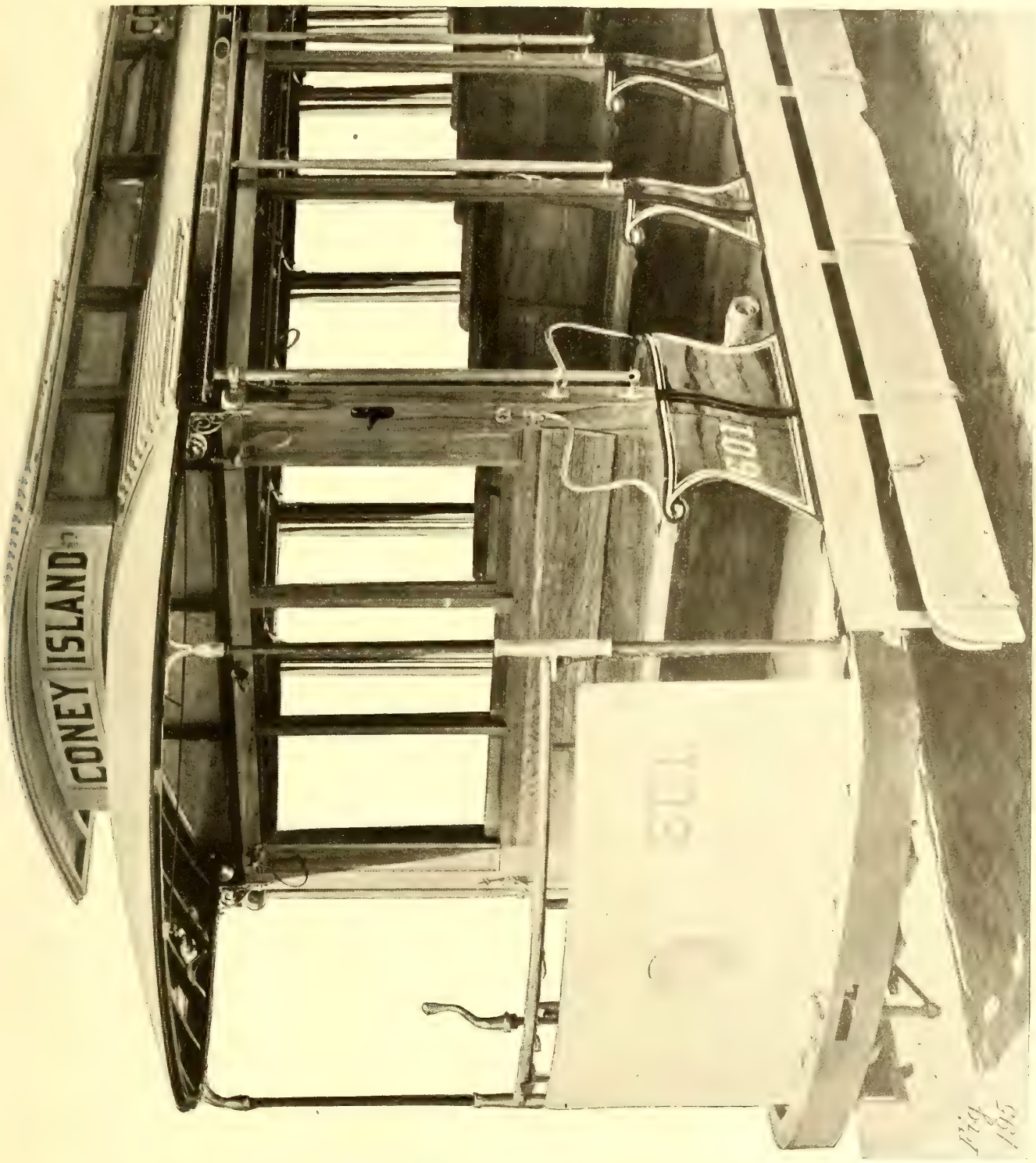


PLATE X. [Figs. 360 to 408.]

DETAILS OF PLATFORMS OF

BROOKLYN OPEN STANDARD CAR

ILLUSTRATING

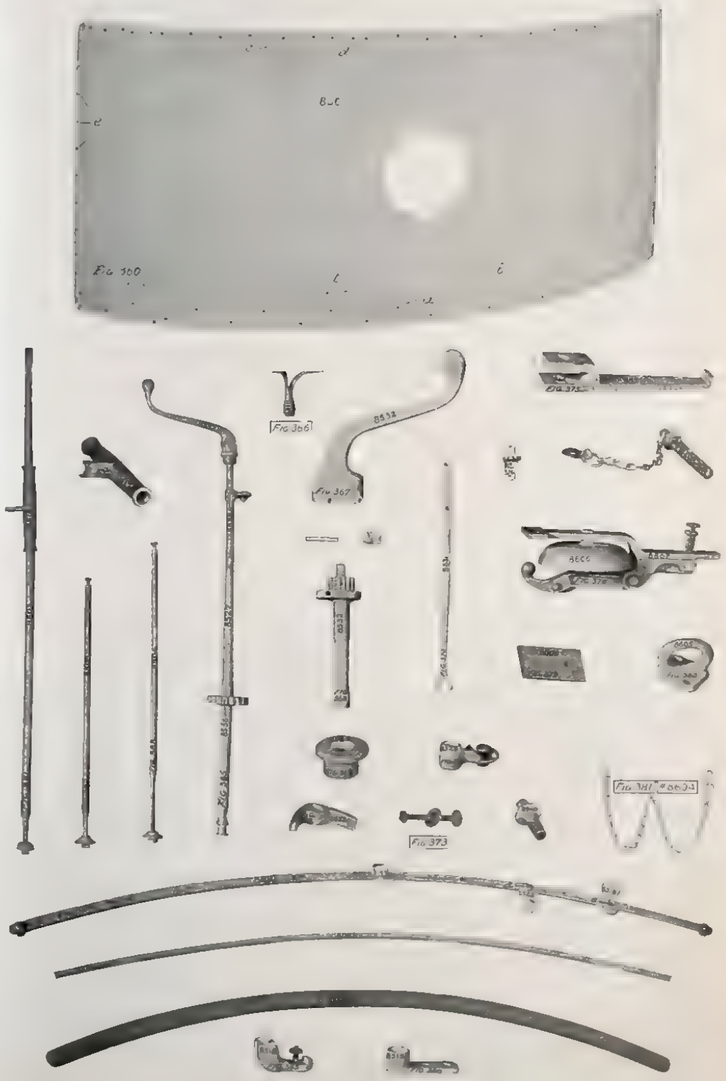
STREET CAR BUILDING

(Stephenson Practice)

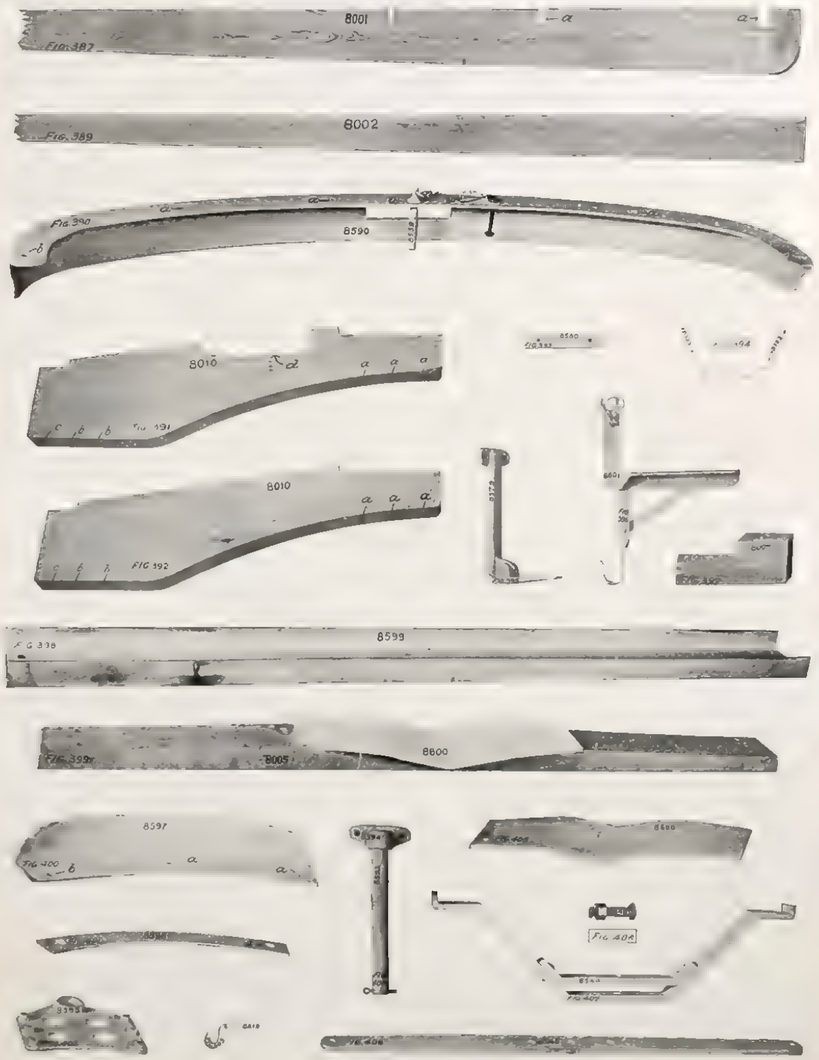
By

Charles Henry Davis, C. E.

BROOKLYN OPEN CAR. (Table No. 38.)



BROOKLYN OPEN CAR. (Table No. 38.)



BROOKLYN OPEN CAR. (Table No. 38.)

PLATE X. [Figs. 360 to 408.]

DETAILS OF PLATFORMS OF

BROOKLYN OPEN STANDARD CAR

ILLUSTRATING

STREET CAR BUILDING

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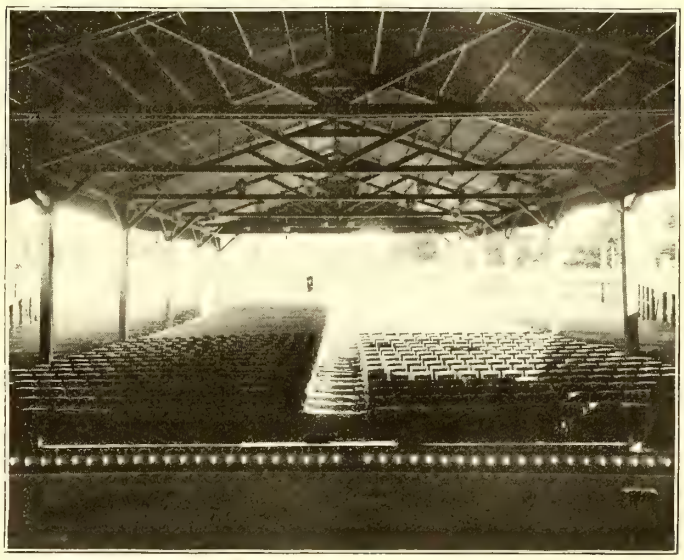
150	4	**Truck rub-plates** (Fig. 401)	8558	W. S.	--	----------	Bolted to side-sills and rubbing-plate beams (5026) Fig. 58, Plate IV., with 8 bolts, 8¾ in. x ⅝ in., through holes (a) and 4 bolts 7⅞ in. x ⅝ in., countersunk heads, through holes (b) Note.—All the pieces described under Con. Nos. 141 to 150 are for use with Brill's Maximum Traction Truck
151	22	**Side-step hangers** (Fig. 395)	8579	W. I.	--	----------	Bolted to the side-sills through holes (g) with 28 round-head bolts 5⅞ in. x ½ in. and 16 round-head bolts 6⅜ in. x ½ in.
152	2	**Side-step tread-boards** (Fig. 387)	8601	Y. P.	--	32 ft. 5 in. x 9¾ in. x 1⅝ in	In 2 pieces, joined together with
153	2	**Side-step splice-plates** (Fig. 393)	8580	S. S.	--	----------	Are now bolted to the step-hanger feet at the notches (a) with 22 round-head bolts 2¾ in. and 22 round-head bolts 2½ in. x 5-16 in.
154	2	**Side-step tread-board facing-irons** (Not Ill)	8581	W. I.	--	33 ft. 0 in. x 1 in. half-oval	Are screwed to the front edge of the tread-boards with 144 No. 14 x 1¼ in. and 4 No. 20 x 4 in. steel screws
155	2	**Side-step toe-guards** (Fig. 389)	8602	Y. P.	--	32 ft. 5 in. x 9¾ in. x 1⅜ in.	Bolted to the legs of the step-hangers with 44 round-head bolts 1 13-16 in. x ¼ in.
156	4	**Side-step hold-up chain and snap** (Fig. 394)	8582	W. I.	--	----------	Screwed to the side-sills with 8 No. 14 x 1 in. steel screws, and
157	4	**Side-step hold-up chain eye** (Fig. 394)	3583	W. I.	--	----------	Bolted to the side-step tread-boards with 8 round-head bolts, 1½ in. x ¼ in.
158	4	**Gooseneck fender-hanger blocks** (Fig. 397)	8007	A.	--	1 ft. 3¼ in. x 6 in. x 3¾ in.	With
159	4	**Gooseneck fender-hangers** (Fig. 396)	8601	W. I.	--	----------	Bolted to crown-piece with 4 cheese-headed bolts 6¾ in. x ½ in. and through the buffer to the platform sills with 4 round-headed bolts, 7¾ in. x ½ in.
160	2	**Dasher-rail caps** (Fig. 384)	8004	C.	--	6 ft. 7½ in. x 2¼ in. x 1 in.	Screwed to the dasher-rails through holes (b) with 12 No. 12 x 1 in. steel screws
161	4	**Platform guard-chains and snaps** (Fig. 381)	8004	W. I.	--	----------	Secured by the eye to the dasher-rails by means of the bolts in holes (c), Fig. 382
162	4	**Platform guard-chain eyes** (Fig. 380)	8605	Bz.	--	----------	Secured to the corner-posts with 8 No. 16 x 1½ in. bronze screws
163	2	**Pedal alarm gongs** (Fig. 378)	8606	S.	--	----------	With
164	2	**Pedal alarm-gong castings and hammer** (Fig. 378)	8607	M. I.	--	----------	Are secured to the floor with 4 bolts 2¼ in. x 7-16 in. and to the crown-piece with 2 bolts 4 in. x 7-16 in.
165	1	**Pedal alarm-gong pin** (Fig. 378)	8608	W. I.	--	----------	Is inserted in hole in nose-piece to operate same
							Assembling has now progressed so far that cabinet work, trimmings, etc., can be next taken up. (*See Table 40, Plate XVI.*) Fig. 195 is reproduced on Plate X., as it shows in position many of the pieces described in this table

Number of Distinctive Pieces	60	(Column 1)
	189	(" 2)
Total Number of Pieces	310	(" 6 and 10)
	322	(" 6 and 10)
Number of Bolts	?	
Number of Screws (about)		
Number of Nails		
Total	821 +	

Summer Theater at Syracuse, N. Y.

At some of the recent national and State street railway conventions some doubt has been expressed by certain street railway managers as to the profit of engaging theatrical troupes as attractions to summer railway parks. That this is not the sentiment of all managers, however, is shown by the number of very tasteful and commodious summer theaters which have been built and operated at



INTERIOR OF THEATER

many railway parks throughout the country during the past season. A number of these have been illustrated in recent issues of this paper, and below will be found several views of the theater built this season by the Syracuse Rapid Transit Railway Company.

The theater was opened July 2 and contains about 1000

VIEW OF VALLEY THEATER AFTER PERFORMANCE, JULY 28

seats. It is provided with a roof, so that the entertainment can be given rain or shine. A stock opera company of twenty-seven people was engaged through a musical bureau in New York, and repertoire opera is given, the bill being changed every week. The opera for the first week was the "Mikado."

Conductors sell tickets for 25 cents, including the round-trip car fare and admission to the opera. Persons who do not ride on the cars to the theater have to pay

25 cents admission. The best seats, which consist of 400 opera chairs, are sold at 25 cents extra. Matinee performances are given on Wednesday and Saturday afternoons, when the general admission is 10 cents. During the first two or three weeks in July the weather was very much against open-air performances on account of rain nearly every day and cold nights, but still with the inclement weather the attendance was good. The business, however, steadily increased, and during the last part of July and the first two weeks in August the gate receipts of the show paid the expenses of the theater, making the car fares clear profit.

The plan was a new one for Syracuse, but it has fully established itself in the minds of the people and the very best people in the city are regular attendants. The park is run in a very high-class manner; no intoxicating drinks are sold within the inclosure, and the managers of the company have now no doubt as to the success of the venture. Besides the direct return from the investment there is also no doubt but that the high character of the performances and the splendid car service to and from the show have been the means of improving the standing of the street railway company with the public and making it more popular.

Important Work in Northern New Jersey

The New Jersey & Hudson River Railway & Ferry Company, which operates an electric line from Hackensack and Englewood to Edgewater, N. J., and a ferry between Edgewater and West 130th Street, New York, has been engaged during the last year upon important extensions to its line. A full description of the Hackensack division, about 3 miles in length, was published in the Street Railway Journal of February, 1900. This section has recently been completed by the opening of a large swing-draw across the Hackensack River, giving an entrance to Hackensack. As this bridge is one of the largest, if not the largest drawbridge in the country, used exclusively for electric railway service, it is worthy of more than passing notice. It was built by F. R. Long & Company, contractors, under the supervision of Ford, Bacon & Davis, consulting engineers of the Railway & Ferry Company.

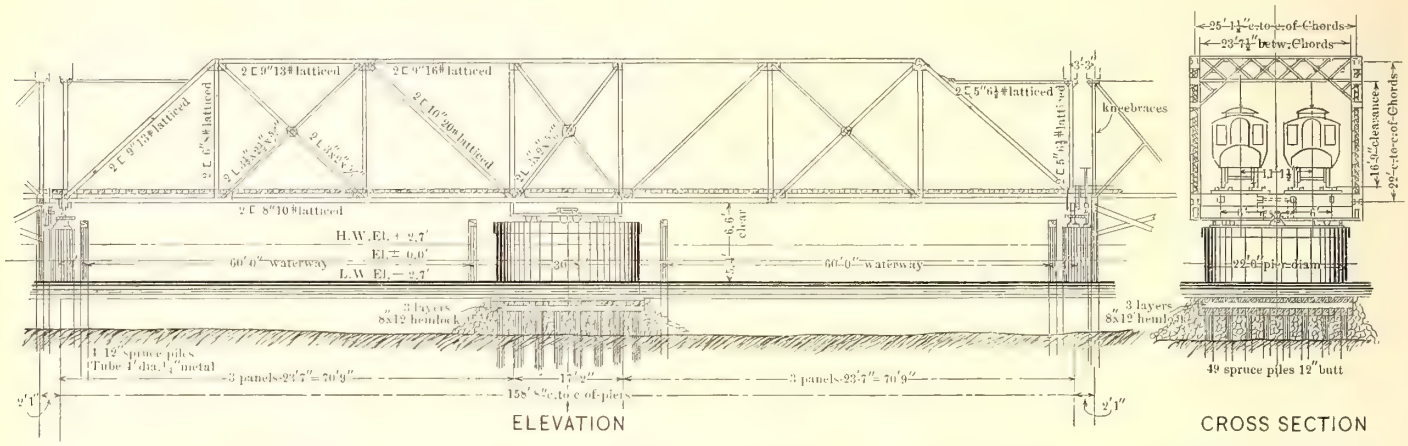


FIG. 2.—SIDE ELEVATION AND CROSS SECTION OF BRIDGE ACROSS THE HACKENSACK RIVER

The approaches to the draw are over trestles at each end. The west side trestle is 915 ft. in length, consisting of sixty-one bents of 15 ft. each. The eastern trestle is 285 ft. in length, and consists of nineteen 15-ft. bents. A standard bent is shown in Fig. 1. The piles, of which there are six in each bent, are all of selected white oak, from 30 ft. to 45 ft. in length. The framing is of long leaf yellow pine, and consists of caps 12 ins. x 12 ins.; girders, of which there are four underneath the track, 8 ins. x 12 ins., and cross and longitudinal bracing, which is 3 ins. x 10 ins. The bracing is bolted and the caps are fastened to the piles by iron dowels. These dowels are 1 in. in diameter, and average from 18 ins. to 24 ins. in length. The holes to receive them were bored 1-16th in. smaller than the dowels, which were covered with white lead and then driven into the hole.

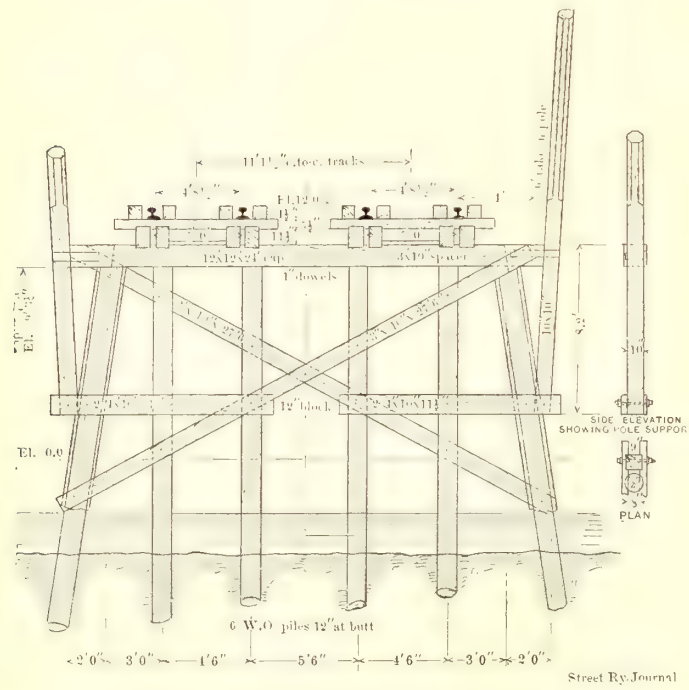


FIG. 1.—STANDARD BENT IN TRESTLE

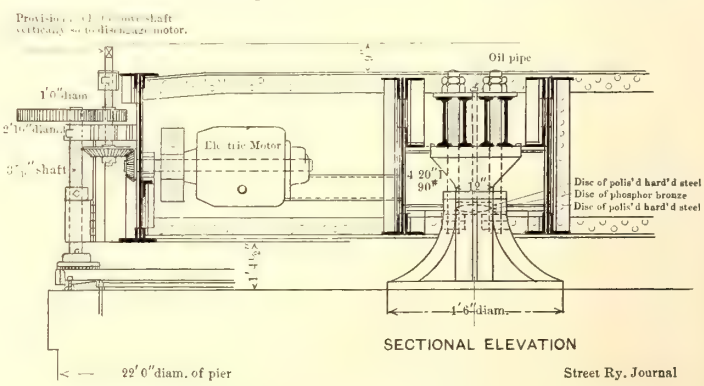


FIG. 3.—ELECTRIC ATTACHMENT FOR OPENING DRAW

The ties and wooden guard stringers are also of yellow pine, the ties being 6 ins. x 8 ins. x 9 ft., and placed 18 ins center to center. The rail is a 60-lb. T. A. S. C. E. standard, with six-bolt joints. The joints are bonded under the fish-plates, and the rails are cross-bonded every six joints. The bridge itself is of the riveted truss type, 160 ft. long, with pivot draw. The center pier consists of piling, on which is a grillage, surmounted by heavy first-class masonry. The end piers are formed by clusters of four piles, each surrounded by a steel casing, 4 ft. in diameter, and filled with best quality concrete. The cross section of the bridge shows the spacing of the tracks, which, as will be seen, is very liberal, to accommodate the extremely wide cars used. The track centers are 11 ft. 1½ ins. apart, permitting two 9-ft.-6-in. cars to pass.

To keep the bridge in line there are four end rests, two on each side; these rests are adjustable from above. In addition, the alignment of the track is kept perfect by the use of four shoes at each end, one of which slides under the ends of each rail, thus holding the latter in line. There are also the usual spring latches. The bridge can be opened by hand or electric power, which is the usual method. For the latter a G. E. 800 motor, with a train of gearing, is used, as shown in Fig. 2, and by it the bridge can be opened and closed in one and one-half minutes. The motor receives its power from a cable connecting the railway feeders with the center pier. The bridge is designed to carry a full load of 30-ton cars on each track.

Special attention was given to the construction of the overhead trolley line on the bridge. As will be seen, the end supports at both the bridge portals and at the shore ends are extremely heavy, being built up of angles, latticed and braced. On the overhead framing, which supports the drawbridge frogs, is attached a short wooden plank, which is backed with an asbestos sheet; the plank was then painted with fireproof and insulating paint. As the frogs which are attached to this board are insulated, a triple insulation is thus secured between the frogs and the iron work of their supports. This substantial construction allows the trolley wire to be kept taut.

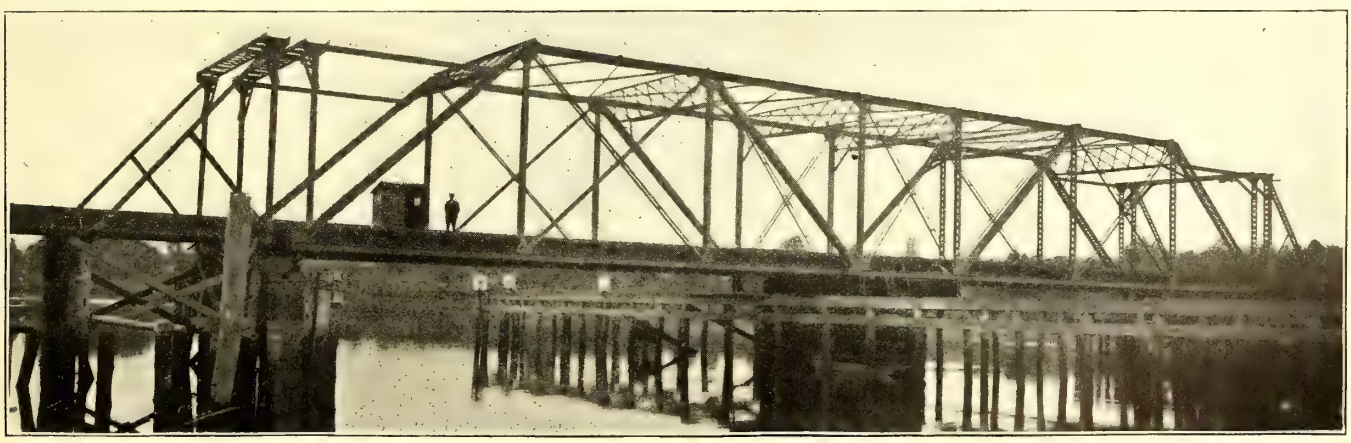
Mention should also be made of the safety devices. Eight hundred ft. from each end of the bridge a cluster of five green lamps, furnished with a reflector, have been installed in a signal box. In addition there are four red lights at a distance of 150 ft. from each bridge portal. Both lamp circuits are closed by the bridge tender just before opening the draw, the lamp near the switch being for the purpose of showing to the tender that the circuits are in working condition. The cars are run over the bridge at full speed.

In addition to the improvements at the Hackensack River, the company has been carrying on other important construction, notably that on the edge of the Palisades, and in the power house, where a 500-kw unit has been installed. A more extended description of these improvements will be published later. The company has also entirely renewed its rolling stock. The closed cars have not yet been delivered, but the open cars have been in use all summer, and are as large and fine as any in use in or near New York. They were designed by Ford, Bacon & Davis, and were built by the American Car Company.

END VIEW OF BRIDGE

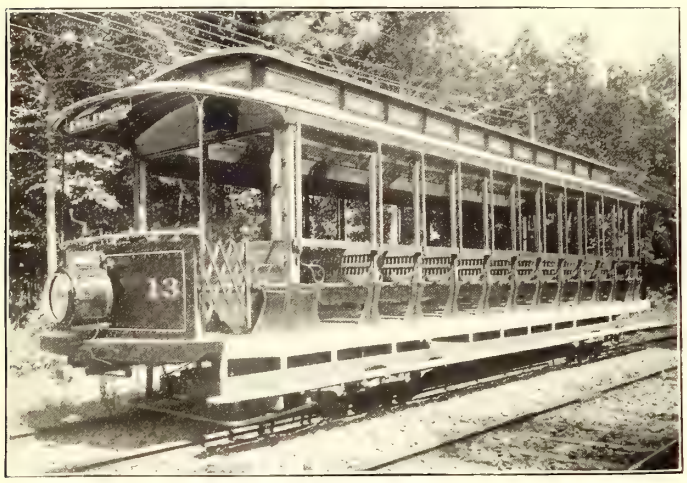
The main dimensions of the open car are as follows: Length over corner posts, 32 ft.; length over dashers, 40 ft.; length over bumpers, 41 ft. 6 ins.; total width over sills, 7 ft. 5⅝ ins.; total width with steps down, 9 ft. 6 ins. The side sills are of long leaf yellow pine, 5 ins. x 7 ins., and each is faced with a ¾-in. x 8-in. continuous steel plate. There is also a regular truss rod for supporting each side sill. The corner posts are of white ash, 4½ ins. x 2½ ins., and all roof rafters are re-enforced with steel.

The interior finish of the car is of white ash, and it is fitted with ten reversible and four stationary benches, each seating six passengers. At the ends of the car are two large windows, the advertising racks over which are reserved exclusively for the notices of the company. The



SIDE VIEW OF 160-FT. SWING BRIDGE

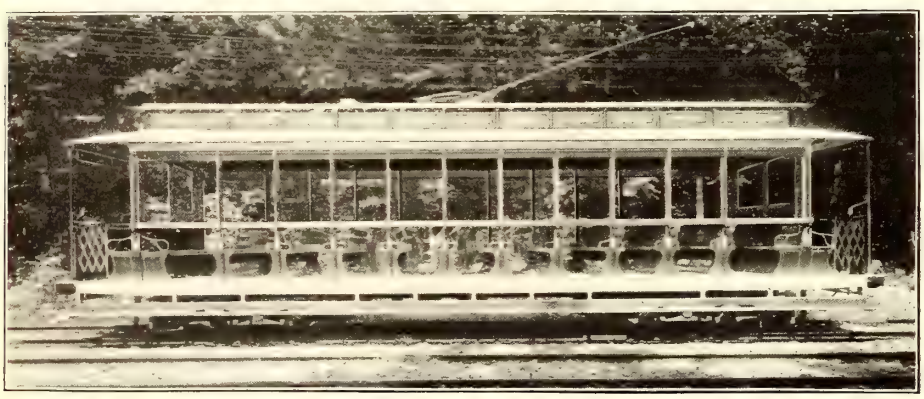
ceilings are of bird's-eye maple. A novelty has been introduced in the electroliers, which are not of metal, but consist of an ornamental wooden cone, carrying sockets in which the lamps are set. This eliminates all danger of crosses, and the cone is much easier to keep in good condition than a metal electrolier. There are three clusters of five lamps each for interior illumination. The bumper is



END VIEW OF CAR

of solid white oak, faced with a ½-in. x 6-in. steel plate. On the roof of the car is a tool box, in which all miscellaneous repair parts are kept, and between the trolley boards is an extra trolley pole. This precaution has been found useful on more than one occasion. The cars are furnished with arc electric headlights, and are also equipped with Vandorn draw-bars, Sterling fenders and registers, Wilson trolley catchers, De Witt sand boxes and the Price momentum brake, manufactured by the Peckham Truck Company.

The subject of braking is a very important one upon this line, as the cars have carried as many as 160 passengers



SIDE VIEW OF CAR

each, and would weigh, when loaded with 200 passengers, 30 tons each. At the same time the line is almost a succession of grades, some of which are as high as 10 per cent, with sharp curves at the base. The managers of the road state that the brakes have given great satisfaction, and are very easy to operate and keep in repair.

Each car is mounted on two 14 B 3 Peckham trucks, with 4-ft. wheel base. Double plate wheels, supplied by the New York Car Wheel Works, are used; they are 30 ins. in diameter, with 3¼-in. tread and 1-in. flange. The motor equipment consists of four G. E. 67 motors, which have a rating of 38 hp each. These motors have no difficulty in carrying the car up the grades, and as an instance of the load which comes upon them, it might be stated that it is not an uncommon thing for one car to draw more than 350 amps. from the line.

Owing to the fact that the cars are wider than those which had previously been used on the line and the fact that in the summer large loads are often carried, it was considered advisable to run a car over the line early in the season, with different loadings, to determine the compression at the different loads, together with the permanent set. The load was secured by filling large paper bags with sand. These bags weighed 81 1-3 lbs. apiece, and with the full loading, eight bags were placed in each seat. The test was a severe one, being more than a car would actually carry in passengers, and the load being more dead than a human load would be. Some of the results of this test, which was made by F. W. Bacon, general superintendent of the Railway & Ferry Company, are given in the following figures:

AVERAGE COMPRESSIONS
(All measurements made from bottom of sills.)

Car Body

Load, 10,000 lbs. compression	17/32 ins.
" 20,000 " "	1 9/16 "
" 25,000 " "	2 3/8 "
Permanent set	7/32 "

Journal Springs

Load, 20,000 lbs. compression	3/16 ins.
" 25,000 " "	10/32 "
Permanent set	1/32 "

(Not including journal spring, that came up ⅛ in.)

Average rise of bolster from 25,000 lbs. to no load.... 1 7/32 ins.

Storage Battery Cars in New York

The Metropolitan Street Railway Company, New York, is now operating four storage battery cars on its Thirty-Fourth Street crosstown line. There are several quite severe grades on this line, but the cars are giving perfect satisfaction, and as fast as more can be secured they will be used to replace the horse cars still in use. The cars are of a large closed type, similar to that of the Broadway cars, room being found for the batteries beneath the seats. The motors and controllers, furnished by the General Electric Company, differ somewhat from those used on the other cars of the Metropolitan electric lines. The type of motor is G. E. 72, and of controller, S-7. A complete charging station has been fitted up at the car house in Forty-Second Street, and the system is expected to satisfactorily supply the needs of crosstown traffic in that section of the city.

The date of opening the entire Broadway line with electric power has not yet been announced, although Mr. Vreeland has stated that the line as far south as the postoffice would be completed, so far as street excavation is concerned, about Sept. 1. All of the Lexington and Columbus Avenues cable lines have been altered. On the latter lines the existing track rails were not changed, but the joints were cast-welded by the Falk process.

The rearrangement of the transfer system in Washington, D. C., and the curtailment of its privileges has met with some opposition from the residents of the city. The inauguration of a double fare on one of the lines of the system has also met with a storm of protests. However, the opposition comes mainly from those who "kick for the sake of kicking." President Stevens, of the company, has given ear to all with supposed grievances, and has convinced the general public of the merits of the new system.

LEGAL NOTES AND COMMENTS

EDITED BY J. ASPINWALL HODGE, JR., OF THE NEW YORK BAR*

Conflicting Decisions on a Question of Contributory Negligence

A New York Appellate Court has just passed upon a legal proposition never before decided in this State, and in doing so has followed a decision in Iowa, which it cites, and decisions in Virginia and Ohio which it does not cite. It expressly repudiates the reasoning by which the courts of Tennessee, Illinois, Missouri, Maryland and Texas have reached an opposite conclusion.—*(Lewin vs. Lehigh Valley Railroad, 52 App. Div., 69.)*

The court holds that, in an action brought by an administrator to receive damages for the next of kin caused by the negligence of the defendant, the negligence of the administrator, who was the father of the infant intestate, contributing to the fatal injuries is not a defense; and that this is so, although the administrator is the sole next of kin and under the statute entitled to the entire proceeds of the action. The court cites the case of *Wymore vs. Mahaska Co., 78 Iowa 396.* The same doctrine is held in *Norfolk R. R. vs. Groseclose, 88 Va., 267,* and in *Cleveland R. R. vs. Crawford, 24 Ohio St., 631,* and *Davis vs. Guarmieri, 45 Ohio St., 470.*

The theory of these cases cannot be defended on the ground that exact or even approximate justice is done, but only on the ground that the action, being created by a statute, the question is not what is justice and right between the parties—the answer to which solves most questions of common law when unaltered by statute—but rather what is the wording of the legislative enactment. Where that says that the administrator shall recover in all cases where the intestate could have recovered had he survived, it must mean that this defense, involving the negligence of a third party—although the party benefiting by a recovery—cannot be successfully interposed. Practical difficulties the court sees, which would arise under any other construction, and which are wholly unprovided for by the statute. For example, if there were several beneficiaries, some of whom were negligent and some were not, how would the fund awarded be distributed?

But the court had difficulties to meet, on the other hand, when confronted with the proposition that its decision was allowing one to profit by his own wrong, a result repugnant to the law. The court only half answers that objection by saying that that proposition applies only to cases where the party's wrong is *wilful,* as where one murdered his grandfather and was not allowed to take under his will. But suppose the act of the father administrator which contributed to the accident was a wilful one, or suppose the act was a joint assault upon the intestate. All the reasons deduced from the wording of the statute for holding that the plaintiff administrator could recover would hold good, including the dreaded complications in distributing the fund, if there were innocent, as well as guilty, next of kin. The court probably felt that this effort to reason away the strength of this maxim prohibiting a profiting from one's own wrongdoing was only partially successful, for it immediately makes the bolder and the safer statement that the court is not concerned with the final disposition of the fund—that is not a part of the proceedings prior to judgment.

There can be no question, whatever view we take of the decisions in the above mentioned States, that the statutes which necessitate or allow them need revision. In the January and February numbers of the STREET RAILWAY JOURNAL we pointed out other analogous evils, and injustices which are the progeny of the carelessly constructed statutes governing this form of action by an administrator for the next of kin.

All the courts of other States which have passed upon this question have taken the opposite view, and held that the negligence of the next of kin who could benefit by the recovery may be proved as a defense to the action.—*(Bamberger vs. R. R., 95, Tenn., 18; City of Pekin vs. McMahon, 154 Ill., 141; Koons vs. R. R., 65 Mo., 592; B. & O. R. R. vs. State, 30 Md., 47; T. M. R. & M. N. Co. vs. Herbeck, 60 Tex., 602.)*

It will be noticed that this question is not one like that which is still waged about the doctrine of imputed negligence. There is involved simply a difference of opinion upon a question of abstract justice, to wit: Shall the negligence of a parent be visited upon the head of an innocent child where such negligence has contributed to the accident to the child damaged? New York was the first to say "Yes" *(Hartfield vs. Ropes, 21 Wend., 615),* and was followed by Massachusetts, Maine, California, Minnesota, Maryland and Indiana, and withstood and contradicted by the courts in nearly all the other States and in England. There the difference of opinion is in the answers to the question, what is just? But in the case we have been discussing the courts do not disagree upon that question at all. They, none of them, hold that it is just that next of kin whose negligence has contributed to the death of the intestate should recover, but some of them hold that the statute compels them to decide contrary to the justice of the matter.

Where a father brings an action for the loss of services of an infant the courts all agree that if his negligence contributed to the accident caused by the negligence of the defendant, he cannot recover.—*Smith vs. Hestonville R. R., 92 Penn St., 450; Metcalf vs. Rochester R. R., 12 App. Div., 147, 158.* This illustrates curiously the injustice of New York, Iowa, Virginia and Ohio (whether necessary under the statutes or not), in the cases brought by administrators.

A father with his child in a carriage is run into by a train and his carelessness is a contributing cause of injuries sustained by the child. The injuries seriously threaten the child's life. They are certain to incapacitate it for work. Whether the child shortly dies as the result of the injuries or lives, incapable, the father has lost the child's services during its minority. If the child dies he can recover damages for such loss (and other damages as well) under the doctrine in *Lewin vs. R. R., supra;* but if it lives he cannot recover under the doctrine in *Metcalfe vs. R. R. supra*—as he should not in either case—because he brought the damage upon himself by his own carelessness, which may have been almost criminal. H.

CHARTERS, ORDINANCES, FRANCHISES, ETC.

CONNECTICUT.—Injunction—Franchises—Power to Lease—Damages—Legal Action.

1. Where defendant's answer, in an injunction proceeding to restrain it from trimming certain trees, alleged that such trimming would not materially injure the trees, a demurrer by plaintiff to such answer admitted the truth of its allegations, and was decisive against plaintiff, since an injunction does not issue to prevent immaterial injury.

2. 5 Sp. Laws, 619, 10 Sp. Laws, 69, 11 Sp. Laws, 1082, and 12 Sp. Laws, 208, 682, authorizing defendant company to take leases of the property and franchises of any other street railway companies with which its tracks may connect, imply power in the latter to give such lease; and, where defendant was a lawful lessee of a franchise to construct and operate a street railway, averments in its answer that it had a right to lay and operate such railway were sufficient statements of its power to do so.

*Communications relating to this department may be addressed to the Editors, Johnston Building, 30 Broad Street, New York.

3. Where a bill for injunction is based on a threatened injury to trees, and no case is made justifying the issuance of the writ, plaintiff cannot recover damages in lieu thereof before the injury is done.—(Huntington vs. Hartford St. Ry. Co., 46 Atl. Rep., 824.)

ILLINOIS.—Charter Powers—Method of Operating—Changes—Parties Entitled to Question. A declaration charged that defendant was authorized by its charter and a municipal ordinance to operate its street cars in a city by means of animal power only; that one of defendant's cars, while being operated by cable power, collided with one of plaintiff's cars, and injured it. It was not alleged that the collision was occasioned by the negligence of defendant's employees in charge of such car. Held, since the question of whether the propulsion of defendant's cars by cable power was an abuse of its charter powers can only be determined in direct proceedings instituted by the State or city, the adoption and use of such power cannot, in an action between individuals, be adjudged of itself to make defendant a trespasser in the street so as to make it liable for injuries not occasioned by its negligence.—(Chicago Gen. Ry. Co. vs. Chicago City Ry. Co., 57 N. E. Rep., 822.)

ILLINOIS.—Eminent Domain—License—Res Judicata.

1. Rev. St. c. 24, art. 5, sec. 1, par. 25, provides that City Councils shall have the power to establish and change the location of any railway within the city. Chap. 131a, sec 2, declares that, when it is necessary for the construction, maintenance, or operation of any street railway to take or damage private property, such taking may be accomplished as exercise of right of eminent domain. Held, that where a city passed an ordinance which claimed to be by authority of chap. 24, and which declared that a certain street railway should locate its line in certain streets and on certain private property, the ordinance was a nullity so far as establishing a route for the railway was concerned, as the taking of private property is authorized only in case of necessity, under the statute, and not upon the judgment of a City Council.

2. Rev. St. c. 24, art. 5, sec. 1, par. 25, provides that City Councils shall have the power to establish the location of any railway within the city. Chap. 131a, sec. 2, declares that, when it is necessary for the construction or operation of any street railway to take or damage private property, such taking may be accomplished as exercise of the right of eminent domain. Held, where a city ordinance declared where the lines of a street railway might be located, and provided it should be located on no private property without the consent of the owner, the ordinance was a nullity as a location, since the railway company was not authorized to adopt the location by virtue of the ordinance, or upon proof of the necessity contemplated by the statute.

3. Where an ordinance declared that a street railway might locate its lines on certain streets and over certain property, and then provided that the location was to be made subject to such further conditions as might be imposed by ordinance when the railway company should adopt the route, and that the ordinance was not to be construed as a grant of rights in any street, but that the determination whether such right should be granted was reserved until a petition for the same should be presented by the railway company, the ordinance was a nullity as a location, in that there was no grant of a right to go upon or along the streets on which the ordinance professed to provide for location.

4. Rev. St. c. 24, art. 5, sec. 1, par. 25, provides that City Councils have the power to establish the location of any railway within the City. Chap. 131a, sec. 3, relative to street railways, provides that no assent shall be granted of the location of the line of the street railway until public notice of the road's petition for a location shall be first given by ten days' publication in some newspaper. Held, that where a city passed an ordinance which declared that a street railway company might locate its line on certain streets without there having been a petition or publication of the notice thereof, the ordinance was a nullity as a location.

5. Where a city gave to a street railway company the right to use certain streets on the condition that the road should grade and gravel the street, and pay $100 a year for a term of years, and the road accepted the burdens and expended $3500 in complying with the conditions, and built its road in the street, an ordinance thereafter passed, prohibiting the occupation of part of the streets occupied, was a nullity, since the license having been acted on, and a substantial consideration received by the city, the license became a binding contract.

6. Where, on proceedings by a street railway company to condemn private property, owners of such property contested the company's right to condemn the same, and the questions raised were taken to the court of last resort, the decision of that court concerning the company's right to take the property settled every objection which might have been raised, whether then raised or not, since the doctrine of *res judicata* embraces, not only what has been actually determined, but extends to any other matter which might have been determined.

7. It is not necessary, as a condition precedent to the location by a street railway company of such portions of its line as are not within, upon, or across a street, nor to the exercise of the power to condemn private property for purposes of its construction, that the consent of the city be obtained, as that may be secured subsequently.—(Harvey et al. vs. Aurora & G. Ry. Co., 57 N. E. Rep., 857.)

KANSAS (United States Circuit Court of Appeals).

1. Appeal—Formal Error as to Parties—Amendment. The fact alone that an action was brought in the name of the wrong party as plaintiff is not ground for reversal, but the Appellate Court will direct the substitution of the proper party.

2. Private Nuisance—Use of Street by Railways—Legislative Authority. Neither by legislative enactment nor by ordinance of a city can the use of a public street be granted to a private corporation for uses which constitute a private nuisance, and result in special injury to the owners of property abutting on the street, except upon making compensation for such injury.

3. Railroads—Grant of Right to Use Street—Construction. A grant to a railway company of the right to "operate and maintain a railway" on a public street does not carry by implication the right to erect and maintain a water tank in the street.

4. Private Nuisance—Use of Property by Railway Company. A railway company has no more right than an individual to so use its property as to unreasonably interfere with the peaceable and comfortable enjoyment by others of their property, or to cause special injury to particular property, without making compensation for the injury.

5. Same—Location of Railway Station Adjacent to Church—Liability for Damages. The erection by a railway company of a water hydrant in a street immediately opposite the center of a church, and only 35 ft. distant, and of a station on property on the opposite side of the street, so that the noises and odors and the dust and smoke incident to the stopping and starting of trains at both station and hydrant interfere with services in the church, and render the building unfit for the uses for which it was built, constitutes a private nuisance, which amounts, in legal effect, to a taking of the church property to the extent of the injury done thereto, for which the company may be required to make compensation; and it is no defense to an action for the recovery of such compensation that the structures built by the company are necessary for the operation of its road, or that its trains are operated in a careful and proper manner.—(Chicago G. W. Ry. Co. vs. First Methodist Episcopal Church of Leavenworth City, Kan., 102 Fed. Rep., 85.)

LIABILITY FOR NEGLIGENCE

ALABAMA.—Personal Injuries—Collision with Hose Cart—Contributory Negligence—Right of Way—Ordinance—Evidence—Instructions—Appeal and Error—Record—Recitals—Assignments of Error—Issues—Waiver.

1. Where the record shows no judgment on either the demurrer to the complaint or the demurrer to the pleas, a statement that a demurrer to each count of the complaint was overruled by the court, and demurrers to pleas Nos. 4, 5, 6, 7 and 8 sustained by the court, is nothing but a memorandum of the clerk, and assignments of error based thereon will not be considered.

2. Where pleas were filed to the complaint, and demurrers were interposed to a part of them, the record failing to show any judgment on the demurrers, they will be regarded as waived; and the judgment entry reciting that "issue being joined," without specifying particular pleas, on appeal it will be considered that issue was joined on all the pleas.

2. Plaintiff, a fireman, was riding on a hose cart driven by the chief driver. The horses were being driven as fast as they could run, and while crossing defendant's tracks collided with a car standing thereon, and plaintiff was injured. There was a car track on the street on which the hose cart was being driven, and crossing the defendant's track. There was a space of about 8 ft. between such track and defendant's car. No effort was made to check the speed of the hose cart as it approached defendant's track. Held, that the manner of driving the hose cart across defendant's track was negligent.

4. In an action by a fireman against a street railway company for injuries received in a collision between a hose cart on which he was riding and one of defendant's cars, an ordinance of the city giving the hose cart the right of way in the street was irrelevant, since having the right would not exempt the driver of the hose cart from the duty of exercising care in driving across defendant's track.

5. Where, in an action for personal injuries, evidence, without conflict, sustained the plea of contributory negligence, it was error to refuse an instruction that, if the jury believed the evidence, they should find for the defendant.

6. In an action by a fireman for personal injuries received in a collision between a hose cart on which he was riding and one of

defendant's cars, an instruction that it did not make any difference in that action whether the driver of the hose cart was negligent or not, unless his negligence was the sole cause of the accident, was erroneous.—(Birmingham Ry. & Elec. Co. vs. Baker, 28 So. Rep., 87.)

CONNECTICUT.—Negligence—Riding on Footboard—Judgment by Default—Nominal Damages. Where a street railway was built along a causeway, which necessitated placing the trolley poles near the track, and defendant, who had knowledge of the situation, was riding on the footboard next to the trolley poles, and refused to step up on the platform at the invitation of the conductor, but leaned back to allow him to pass by, and struck his head against a trolley pole, plaintiff was entitled to nominal damages only on default, since he was guilty of contributory negligence.—(Nugent vs. Fair Haven & W. St. Ry. Co., 46 Atl. Rep., 875.)

ILLINOIS.—Jumping on Moving Car—Proof of Custom—Encouragement of Custom—Negligence *per se*—Circumstances—Instruction—Province of Jury.

1. Where, at the transfer station from defendant's electric line to their cable cars, the latter were started by the car-house cable, and were carried by their own momentum a distance of 50 ft., to where the down-town cable was picked up, and the plaintiff, who had run after a car while it was moving slowly of its own momentum, and stepped on the platform, was thrown and injured by the sudden jerk occasioned by the picking up of the down-town cable, evidence that passengers during the crowded travel of the morning hours were in the habit of running after the cars and jumping on them at that point was incompetent for the purpose of establishing a standard of ordinary care.

2. Evidence that it was the custom of passengers during the crowded travel of the morning hours, to so run after and jump on the cars, and that the defendant's conductors encouraged them in so doing, by assisting them on the car and telling them to come on, was competent to show negligence on the part of the defendant.

3. An instruction that the court did not mean to give an opinion as to what were or were not the facts in the case, but that it was solely and exclusively for the jury to determine from the evidence, and having done so to apply to them the law as stated in the instructions, was not objectionable as giving the jury to understand they were independent of the law.—(North Chicago St. Ry. Co. vs. Kaspers, 57 N. E. Rep., 849.)

MINNESOTA.—Collision with Traveler—Contributory Negligence.

1. The reciprocal relations of the public and a street railway company vary according to circumstances and conditions. Distinction made as to their relative rights and duties in the populous and in the sparsely settled parts of a city. Held, that the driver of a vehicle who drove upon a street railway track in the suburban, thinly settled district of a city, where the public use of the street was limited, without looking for approaching cars, was guilty of negligence.

2. One who, under such conditions, is riding in a rear seat, and who has no direct control over the horses at the time, but who is a joint contributor to the hire of the team for the occasion, is guilty of negligence if he does not look for approaching cars upon crossing a street car track.

3. Under the circumstances of this case, a mere passenger, who has no control over the team, was not guilty of negligence in failing to look out for cars when crossing the track.

4. Certain assignments of error examined and held to be not sustained.—(Wosika vs. St. Paul City Ry. Co.; Shindelus vs. Same, 83 N. W. Rep. 386.)

MINNESOTA.—Injury to Person on Track—Question for Jury.

1. As a general rule, it is a question of fact for the jury, to be determined from all the circumstances of each case, whether a party is guilty of negligence in attempting to cross a street railway track without first looking and listening for approaching cars.

2. Rule applied, and held, that the question of the plaintiff's contributory negligence in this case was one of fact and not of law.—(Riley vs. Minneapolis St. Ry. Co., 83 N. W. Rep., 376.)

MINNESOTA.—Accident to Person on Track—Evidence. This is a personal injury action. The plaintiff, in the nighttime, was thrown from his bicycle upon the street car tracks of defendant, and thereby rendered unconscious. While in this condition he was struck and injured by one of the defendant's cars. One of his specifications of negligence was that the defendant permitted the headlight of the car to become defective, dirty and grimy, so that it did not sufficiently light its tracks. A witness who was present at the time of the accident was permitted to testify that subsequent thereto, and for a year, he observed the headlights on other cars of the defendant at different times and under different conditions, and that they gave a better light, and showed further on the tracks, than did the one in question on the night of the accident. Held, prejudicial error.—(Moldenhaur vs. Minneapolis St. Ry. Co., 83 N. W. Rep., 381.)

MINNESOTA.—Collision with Wagon—Evidence—Damages. These are personal injury actions. Held, in each case:

1. That the finding of the jury to the effect that the defendant was guilty of negligence, and the plaintiff was not chargeable with contributory negligence, is sustained by the evidence.

2. That the amount of damages in one of the cases is excessive.—(Durose vs. St. Paul City Ry. Co. [three cases], 83 N. W. Rep., 397.)

MISSOURI.—Injury to Pedestrian—Contributory Negligence—Violation of Ordinances—Civil Liability—New Trial.

1. A decedent's contributory negligence will bar a recovery of damages for causing his death, in the absence of allegations and proof of wantonness or wilfulness in causing the injury, though defendant may have been negligent.

2. Where a verdict is in accordance with the law, the granting of a new trial is error, though the court committed error in refusing instructions.

3. The violation of a city ordinance requiring a motorman to keep a vigilant watch for persons on or moving toward the track, and on the first appearance of danger to stop the car in the shortest time possible, and prescribing a penalty for failure to comply therewith, will not authorize a recovery against the company for causing the death of a person on the track, without proof that such company had agreed to or contracted to be bound by such ordinance, since the city cannot by ordinance create a right of action between third persons, nor enlarge the common-law liability of citizens between themselves.

4. Where a city ordinance regulating the operation of street cars is not enacted for the special benefit of any person or class of persons, but simply pertains to the conduct of the companies to the community as a whole, no other liability follows a violation than the penalty imposed by the ordinance itself, and hence its violation confers no right of action by third persons.—(Holwerson vs. St. Louis & S. Ry. Co., 57 S. W. Rep., 770.)

NEW JERSEY.—Appeal — Review — Conflicting Evidence—Comments by Court.

1. When the evidence of witnesses in a cause on trial is in conflict, it is the province of the jury to determine which of it is to be taken as true—to determine the credibility of the witnesses, and in which direction the weight of evidence exists; and the verdict will not be set aside unless it be against the clear weight of evidence, or is found to be the result of the feeling, bias or prejudice of the jurors.

2. Comments of the trial court upon the evidence, fairly made, and which do not mislead the jury, if the facts be left to the jury to determine for themselves, will not be cause for setting aside a verdict.—(Faulkner vs. Paterson Ry. Co., 46 Atl. Rep., 765.)

NEW JERSEY.—Collision—Injuries—Negligence of Motorman—Verdict—Evidence. Where it appeared that, when plaintiff drove onto defendant's street car track, its car was several hundred feet away, and nothing prevented the motorman from seeing him, though the track was slippery, a verdict in his favor for injuries sustained in a collision with the car will not be set aside.—(Sickler vs. North Jersey St. Ry. Co., 46 Atl. Rep., 779.)

NEW JERSEY.—Injury to Driver of Wagon—Contributory Negligence. One who, while driving on a street in front of an approaching street car, turns his team onto the track in front of the car without turning around to see whether or not a car is approaching, and is struck by the car for the reason that it is too near him to be stopped after his intention to drive onto the track becomes apparent, is guilty of contributory negligence.—(McHugh vs. North Jersey St. Ry. Co., 46 Atl. Rep., 782.)

NEW JERSEY.—Injury to Child on Track—Contributory Negligence.

1. The rule of duty which requires the ordinary traveler in crossing a street railway to use his powers of observation to discover approaching vehicles, and his judgment how and when to cross without collision, is also binding upon a child who is *sui juris*.

2. In actions for injury to a child of that degree of responsibility when so crossing a street railway, the question of contributory negligence is generally one for the jury; but where it appears beyond dispute that the child, in its attempt to cross, acted in entire disregard of the degree of prudence which may be reasonably expected from one of his years, and has thereby contributed to the collision that caused the injury, then the question, contrary to the usual rule, becomes one for the court to determine.

3. In the present case the plaintiff was a girl nine years of age, who was in the act of crossing a trolley track in a city street, and was injured by collision with an approaching car. Under the circumstances, as developed by the plaintiff's evidence at the trial, a nonsuit was granted. On error, held, that the nonsuit should be

sustained on the ground of contributory negligence.—(Fitzhenry vs. Consolidated Traction Co., 46 Atl. Rep., 698.)

NEW JERSEY.—Assault on Passenger—Damages. Plaintiff, while a passenger on a street car, was assaulted by the conductor and thrown from the car. After the assault he was not able to work for eight weeks, and since then only able to work eight hours a day, and earn $8 a week. Before he was assaulted he worked from twelve to fourteen hours a day and earned from $10 to $18 a week. He received a slight scalp wound, had a rib fractured, spit a little blood, and suffered a great deal of pain. His physician stated that thirty-three days after the injury he was apparently cured, and that his bill was $62. The jury awarded plaintiff $2500. Held, that the damages were excessive and should be reduced to $1200.—(Fohrman vs. Consolidated Traction Co., 46 Atl. Rep., 783.)

NEW JERSEY.—Carriers—Degree of Care—Crowding Trolley Car.

1. A common carrier of passengers must use a high degree of care to protect them from dangers that foresight can anticipate.

2. By "foresight" is meant not foreknowledge absolute, nor that exactly such an accident as has happened was expected or apprehended, but, rather, that the characteristics of the accident are such that it can be classified among events that, without due care, are likely to occur, and that due care would prevent.

3. The crowding of a trolley car, and especially of those parts of it that are used for entrance and exit, is attended with a liability to danger that the carrier should anticipate and employ care to avert.—(Hansen vs. North Jersey St. Ry. Co., 46 Atl. Rep., 718.)

NEW YORK.—Injury—Conflicting Evidence. In an action for injuries caused by being thrown from a moving street car, where the evidence of plaintiff and defendant was conflicting, a nonsuit was properly denied.—(Kelly vs. Brooklyn Heights R. Co., 64 N. Y. Suppl., 64.)

NEW YORK.—Liability for Injuries—Streets—Contract to Maintain.

1. Where a street railway company contracted with a township to keep the streets and highways in a safe and passable condition, while constructing its road, an action for an injury resulting from the dangerous condition of the highway, may be maintained against the company by the person injured.

2. Same—Sufficiency of Evidence. A street railway company had contracted with a township to keep the streets and highways in a safe condition while constructing its road therein. Plaintiff was injured by reason of the unsafe condition of such road. The evidence for the plaintiff showed that the company had not worked on the line for two months, while defendant's witnesses testified that it had been completed for six months. Held, insufficient to support a finding that the road was being constructed at the time of the accident, so as to entitle plaintiff to recover against the company.

3. Motion to Dismiss—Waiver. Where defendant moved to dismiss the complaint for insufficiency of evidence, at the close of plaintiff's case, and stated wherein the evidence was insufficient, and such deficiencies were not supplied, defendant did not waive the right to insist that the cause should not be submitted to the jury by failing to again specifically set out the grounds of the objection in a motion to dismiss, which was made after the evidence was closed.—(Sullivan vs. Staten Island Elec. R. Co., 64 N. Y. Suppl., 91.)

NEW YORK.—Evidence—Speed of Car—Competency of Witness.

1. A witness who has driven wagons for twenty years, and who testifies that he is familiar with the speed of wagons, is competent to testify as to the rate of speed at which a street car was running at a particular time, and which he had a chance to observe.

2. Same. It is not error, in an action for injuries sustained by collision with a street car, to refuse to permit a witness to state whether a car was running fast or slow, where he states that he did not notice its speed.—(Garduhn vs. Union Ry. Co., of New York City, 64 N. Y. Suppl., 210.)

NEW YORK.—Review—Sufficiency of Evidence.

1. Where there is evidence in the record sufficient to sustain the judgment of the trial court, it will not be reversed on appeal as against the weight of the evidence.

2. Permanent Injuries—Damages—Instructions. Where, in an action for injuries resulting from defendant's negligence, plaintiff testified that his memory had been impaired by the injury, and a physician testified that loss of memory was a reasonably certain result of such injury, it was not error to refuse to instruct that no damages could be had for permanent injuries.—(Jena vs. Third Ave. R. Co., 64 N. Y. Suppl., 88.)

NEW YORK.—Negligence of Independent Contractor—Liability—Joint Tort Feasors.

1. Plaintiff was injured by the upsetting of a carriage caused by an embankment from 4 ft. to 7 ft. high, which had been thrown up in the public highway by the defendant contractors under a contract with the defendant railway company, preparatory to building an elevated roadway over the defendant company's track. On the night of the accident there was no light to warn travelers of the presence of the embankment. The Supreme Court had authorized the railway company to build the roadway, and also ordered the company to comply with the requirements of General Railroad Law, sec. 11, which authorizes railway companies to excavate, fill in, or change the grade of a highway when necessary to carry its line across the roadway. Held, that the defendant railway company was liable for the injury, as a joint tort feasor, and could not escape liability under the rule that exempts a party from damages for the negligent act or omission of an independent contractor, who has undertaken work for the benefit and at the instance of the party with whom he contracts; since the railroad company, having interfered with the highway under the permission of a statute, had imposed on it the implied obligation to protect the public from accidents by reason of such interference.

2. Same—Excessive Damages. Where plaintiff was thrown from a carriage and seriously injured, by reason of which she was confined to her bed for many weeks, and used crutches for three months after the accident, and eighteen months thereafter had not fully recovered, and probably never would be completely restored to health, a verdict of $8000 was not excessive.

3. Instructions—Co-Defendants. Where a requested instruction related wholly to the respective rights of the co-defendants, and had no bearing on the rights of the plaintiff, a judgment in favor of the plaintiff will not be reversed because of the refusal to give such instruction.—(Deming vs. Terminal Ry. of Buffalo et al., 63 N. Y. Suppl., 615.)

NEW YORK.—Collision with Team—Negligence. A finding that a collision of street car with a wagon at the intersection of two streets was caused by negligence of the motoneer, without contributory negligence of the driver, is warranted by evidence that the driver, on coming east from a point 10 ft. from the west crossing, saw the car coming south 100 ft. from the north crossing; that while driving the team at a "moderate trot," without lessening his speed as he approached the track, and "looking for other vehicles and pedestrians that might be on the other crossing," the wagon was struck on the hind wheel by the car; and that the motorman gave no warning of the car's approach, and made no effort to check its speed, though he saw the team as he approached the northerly crossing, and could have stopped the car within 12 ft.—(Piercy et al. vs. Metropolitan St. Ry. Co., 62 N. Y. Suppl., 867.)

NEW YORK.—Credibility of Witness—Hostility.

1. In an action against a railway company for injuries, the fact that a witness for plaintiff, who was also her attorney, had, as an attorney, brought other actions against defendant, is not sufficient to show that, as a necessary consequence, he must entertain malice against defendant sufficient to affect his credibility as a witness.

2. Same—Appeal—Harmless Error. The sustaining of objections to questions put to a witness introduced by plaintiff, who was also plaintiff's attorney, tending to elicit evidence of his hostility to defendant from the fact that as attorney he had prosecuted other actions against defendant, if error, was not prejudicial, where the witness' hostility was made manifest by other evidence.—(Franklin vs. Third Ave. R. Co., 65 N. Y. Suppl., 434.)

WISCONSIN.—Judgments—Verdict—Contributory Negligence—Duty to Look and Listen.

1. A decision of the Supreme Court in an action by a wife alone for personal injuries will, under the rule of stare decisis, control a subsequent action of the husband to recover for the same injuries, in so far as there is a substantial identity in each case.

2. It is not error to direct a verdict for defendant in an action against an electric street railway company to recover for injuries sustained by one of defendant's cars, where there is no direct evidence of defendant's negligence, but there is evidence showing plaintiff to be guilty of contributory negligence.

3. A motorman on an electric street car may presume that one driving a carriage in front of his approaching car, and who he sees is about to turn upon the track in front of his car, will desist from so doing when he sounds the gong of his car; and he is only bound, as an ordinarily careful man, to exert efforts to stop his car after he sees that his warning is unheeded.

4. A driver of a buggy, whose ears are muffled in a seal-skin cap and coat, is guilty of contributory negligence in driving on an electric street car track without looking any considerable distance up or down the track to see if a car is approaching, since in such case she is deprived of a warning through the sense of hearing.—(Cawley vs. La Crosse City Ry. Co., 82 N. W. Rep., 197.)

A Large Convertible Car

The engravings which accompany this article show two views of a double-truck, twelve-bench, convertible car recently built for the New Castle Traction Company, of New Castle, Pa. This car is one of a lot supplied this company by the J. G. Brill Company, and is the largest of the kind yet turned out. The idea of the convertible car is one which is receiving much attention from street railway men at the present time. The public are everywhere, even in our northern cities, clamoring for an open car during the warmer weather. They are equally clamorous to have these cars taken off whenever a cold wave interrupts the pleasant weather, and they object, very rightly, to the use of them during chilly weather late in the fall or early in the spring, yet throughout the year, even in winter, there are days when the use of such cars materially increases the traffic of a street railway. Boards of Health in some cities where open cars are extensively used have found it necessary to interfere and demand that a certain proportion of closed cars be run the whole year round. The railway manager at the present time is confronted with the problem of a double equipment, half of which only can be used at any one time. This, of course, means double storage capacity, with all the attendant expenses, and it also means, if the public are to be thoroughly accommodated, the storage shall be arranged in such a manner as to make it possible to change from one to the other kind of car at the shortest possible notice. Actual practice succeeds only in using a double equipment, and keeping the open car in service as long as possible. It is put on weeks before the proper time in the spring in order to take advantage of any stray warm days which might occur, and it is often kept on in the fall a month longer than is comfortable for many of the traveling public.

The aim in designing the Brill convertible car was to have a single equipment which could at all times give the railway manager the car he mosts needs at the required time. Furthermore, it provides a car which is entirely self-contained, and is at all times ready to be changed from one type to another without going to the shops or car houses, and without further labor than that which can be given by the motorman and conductor in a few minutes. With an equipment of this character the storage capacity of the car houses is reduced practically one-half; there is a corresponding diminution in the sizes of buildings, the quantity of land required, attendance necessary and capital invested.

How perfectly the Brill car has answered the requirements can be judged from the engravings and from the accompanying description. Fig. 1 shows the car open for summer use. It is in all respects a standard cross seat, center aisle open car. From a layman's point of view it is identical with the usual type. The expert notices, perhaps, the panels in the corner and certain minor details of construction, as for example the form of grab handles and positions of the panels. Fig. 2 shows the car closed, the steps folded up ready for winter use. It is practically a standard box car on double trucks. It is true there is a folding step and grab handles at each window post, but the arrangement of the windows and panels is similar to that of the ordinary car. With the exception of the fact that the windows rise instead of drop, the car is, as far as the passengers are concerned, the same in operation and arrangement as a closed car. The curtains operate in the same way—when closed they come to the window rail; when open they come all the way to the floor. These New Castle cars have twenty-four benches and seat forty-six persons, one of the stationary seats at each end of the car accommodating one person only. The open car has the Brill round-corner seat end panels, which give great ease of entrance from the sides.

The cross-seat car is being looked upon with more and more favor by street railway men, and several large companies are ordering them extensively. The idea is that there is a profit in carrying seated passengers, and that when seated people are more comfortable if they face in the direction in which they are moving.

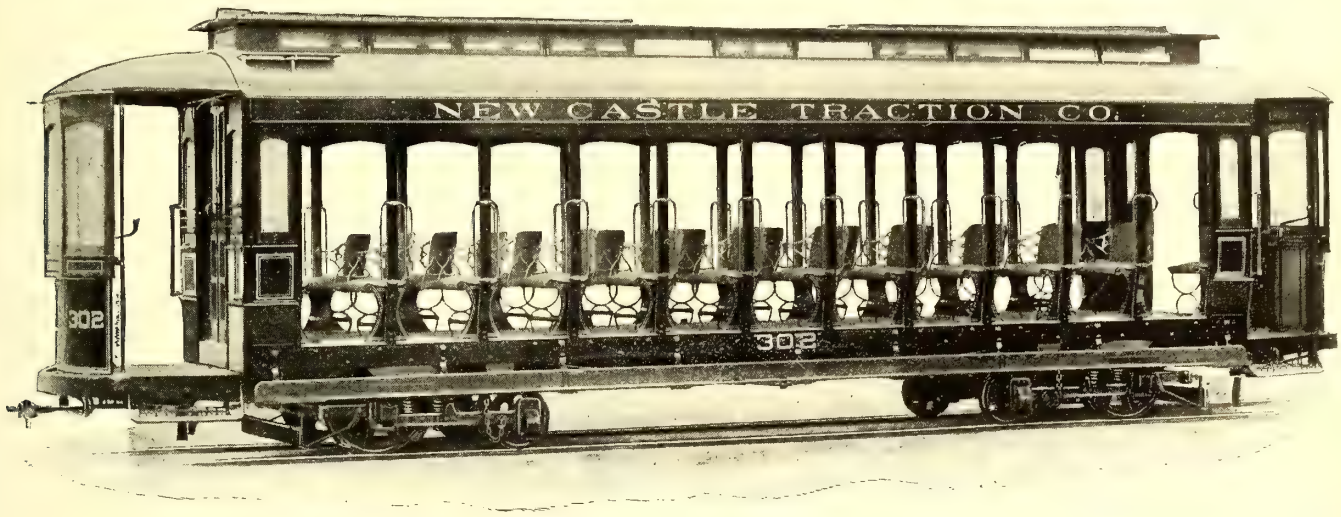


FIG. 1—CONVERTIBLE CAR FOR NEW CASTLE, OPEN

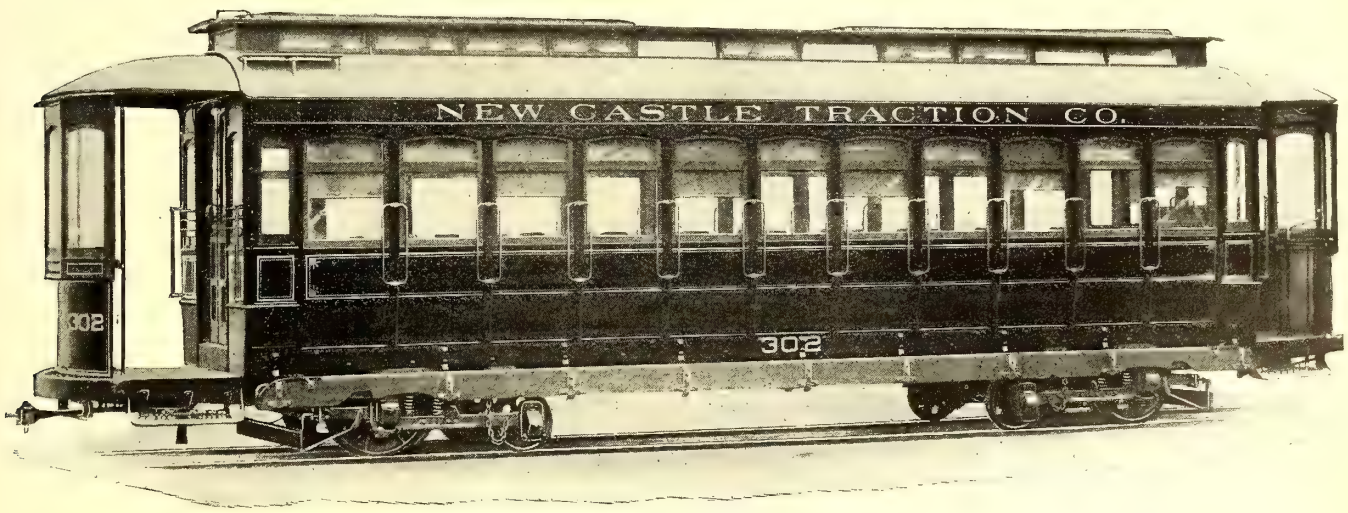


FIG. 2—CONVERTIBLE CAR FOR NEW CASTLE, CLOSED

The following are the principal dimensions and details of these cars: The length over end panels, 30 ft. 8 ins.; length of platform, 4 ft.; length over dasher, 38 ft. 8 ins.; width at the sills, 6 ft. 8¾ ins.; width over the posts, 7 ft. 5½ ins. The extreme width of the car when the steps are down is 8 ft. 8 ins.; when they are up the extreme width is 7 ft. 8 ins. The height of the platform steps is 14 ins. from the head of the rail; the riser is 13 ins. The long step or running-board is 19 ins. from the track and 15 ½ ins. from the step to the floor of the car. The width of the car inside at the center is 8 ft. 2½ ins., and the body is 9 ft. 3½ ins. from the bottom of the sill over the trolley board. These cars were mounted on maximum traction trucks, with driving wheels 33 ins. in diameter, 2-in. tread and ⅝-in. flange. They were fitted with electric brakes, Brill angle-iron buffers, Brill portable vestibules, radial draw-bars, two sand-boxes, two Dedenda gongs. The General Electric Company furnished cables, controllers and resistances. The side panels are of the new type, having metal on both sides of the slats, making a very warm car side, and, being flexible, they fill the groove completely. The interior of the car is so nearly identical with those ordinarily used that even an experienced railroad man would not be likely to note the fact that there was anything unusual in the construction. The center of the car, perhaps, appears a little more lofty than usual. The ventilators and monitor deck are the same. The construction of the roof is such as to give this car an unusual amount of stiffness and strength. The letter board and panels are made from a single piece, and are halved upon the posts and carlines. The necessary interior furring strips also anchor each of the carlines, while the carlines being wider than usual at the foot and made up as part of the posts are much stronger than those of any ordinary car. Although this design has been in use long enough to have made its weak points visible, no faults of any consequence have appeared. Cars of this type have been in a number of accidents which have demonstrated their unusual strength.

Electric Freight Locomotive at Whitinsville, Mass.

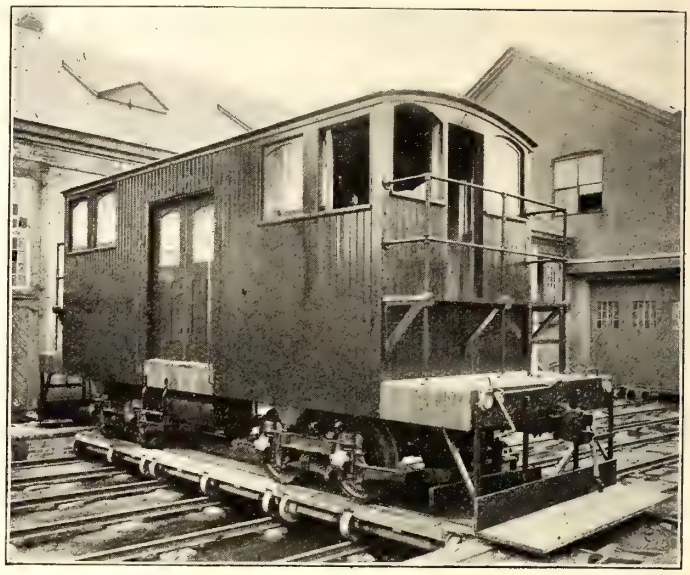
The use of electric locomotives is increasing, not only for passenger but also for freight transportation. Several recent electric freight locomotives have been described in these pages, and views of a recent machine of this class, built by the Taunton Locomotive Manufacturing Company for the Whitin Machine Works, of Whitinsville, Mass., are given herewith.

The main frame of the locomotive body consists of two end

INTERIOR OF CAB

sills of 8-in. x 12-in. oak, eight longitudinal sills of 4⅝-in. x 11-in. yellow pine, and two bolsters of 8-in. x 11-in. yellow pine. On this frame is laid a flooring of 1¾-in. spruce. The cab, which is built on this frame, is constructed of four corner posts of 6-in. x 6-in. yellow pine, and belt rails, door framing and side braces of 2¾-in. x 4-in. yellow pine. The end roof carline is of 2½-in. x 3-in. white pine curved, and the other roof carlines are 1¼-in. x 9½-in. yellow pine. The outside roofing and sheathing is of ⅞-in. North Carolina pine, and the inside roofing and sheathing is of ⅞-in. North Carolina pine, except for about 4 ft. at each end, where the roof carlines were made circular on the under side, as well as the top, so as to allow the platform to be placed as high as possible, and the sheathing was reduced to ⅜ in.

The locomotive is mounted on Peckham No. 14 B-3 double trucks, fitted with 33-in. wheels on 4½-in. axles. The electrical equipment consists of four G. E. 57 railway motors, whose armatures are wound for slow speed, each coil containing six turns. Series parallel controllers allow the operation of the locomotive at a speed of 5 to 6 miles per hour on the series slow running point, and 9 to 12 miles per hour on the multiple point. The



GENERAL VIEW OF LOCOMOTIVE

six-panel resistances are under the cab platforms, with the idea of utilizing their heat in the winter time to warm the cab.

The automatic air-brake apparatus with which the locomotive is equipped was supplied by the Christensen Engineering Company, and will operate in connection with any of the standard automatic brakes. The locomotive is accordingly supplied with coupling hose in order that the air brakes may be used on any freight car which it has to handle.

The motor compressor is situated underneath the engineer's platform at one end of the car, and has a capacity of compressing 20 cu. ft. of free air per minute to 100 lbs. pressure. The main storage reservoir is placed beneath the car, as are the brake cylinder and the auxiliary reservoir, and is connected by piping to the compressor and to the engineer's valves at the ends of the locomotive. The auxiliary reservoir is piped to the triple valve on the tail of the brake cylinder, which is in turn connected to the engineer's valves. The locomotive is supplied with whistles, one at each end, which are blown by compressed air.

Reduced Tariff on Electrical Machinery in Italy

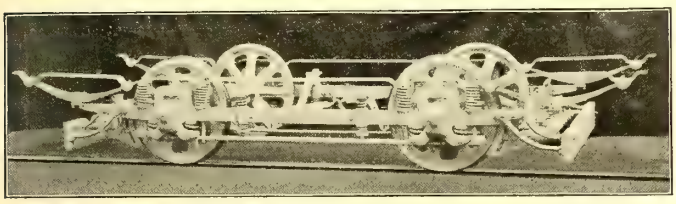
The United States State Department has made public the text of the new reciprocity treaty with the Kingdom of Italy. In consideration of reductions in the United States tariff upon certain Italian products, chiefly wines, the Italian government proposes to lower its duties on some six or seven articles of American manufacture, among them scientific apparatus, dynamo-electric machinery and varnish. Under the agreement the Italian import duties on these manufactures will not exceed the following figures:

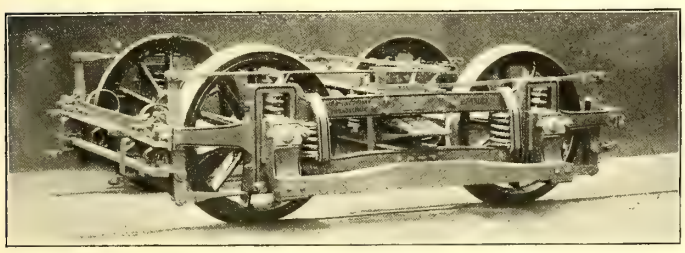
Articles	Rate in Lire Per Quintal
Scientific instruments:	
(a) Of copper, bronze, brass, or steel.	
(1) With spy-glasses or microscopes, or graduated scales or circles, spy-glasses for use on land, monocles, binocles, lenses, detached and mounted	30.00
(2) Not provided with any optical instrument nor with graduated scales or circles	30.00
(b) Of all kinds, in the construction of which iron is evidently predominant	30.00
Upon dynamo-electrical machines:	
Upon varnishes, not containing spirits nor mineral oils	20.00
(1) The weight of which exceeds 1000 kg	16.00
(2) Weighing 1000 kg or less	25.00
Upon detached parts of dynamo-electrical machines	25.00

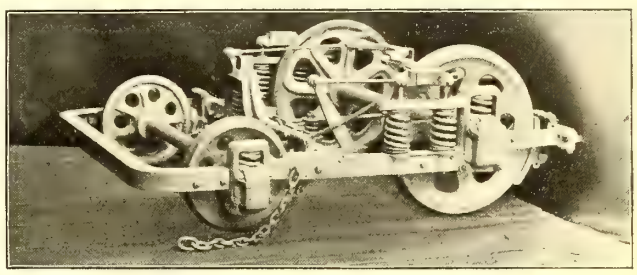
The treaty, which must first be approved by the Italian Parliament, will continue in force until the expiration of the year 1903, and if not denounced by either party one year in advance of the expiration of said term, it will continue in force until one year from the time when one of the high contracting parties shall have given notice to the other of its intention to arrest the operation thereof.

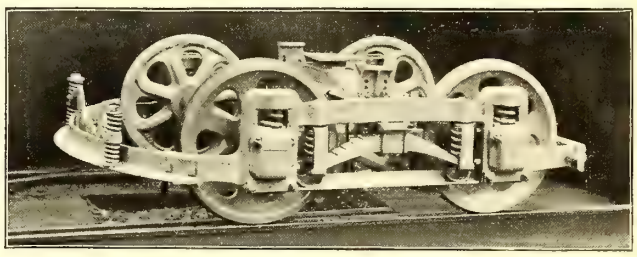
The Brill Exhibit at the Paris Exposition

Reference was made in the last issue to the exhibit at the Paris Exposition of the J. G. Brill Company. The principal objects shown are illustrated herewith. As with most of the transportation exhibits, part of the apparatus shown is in the Champs de Mars section and part in the Transportation Building at Vincennes.









BRILL CARS AND TRUCKS AT THE PARIS EXPOSITION

The exhibit in the former comprises four quarter size truck models showing respectively: A model of the 27-G, of the 21-E, of the Maximum Traction and No. 27 trucks. The chief exhibit of the Brill Company, however, is at the Vincennes annex. The most conspicuous objects here are the snow sweeper, illustrated in July, and a Brill convertible car complete, mounted on a 21-E truck. This convertible car, which is illustrated herewith, was constructed to meet the requirements and restrictions imposed by French government officials relating to tramway rolling stock.

There is also shown one 27-G bogie truck, similar to other trucks of this same type which the company has furnished for use on French tramways; also one maximum traction truck of the same construction, as are now being furnished for use under French cars.

The maximum traction truck exhibited is fitted with solid forged wrought iron side-bars, this being one of the latest improvements in double-truck construction. The 21-E truck is also fitted with these solid forged iron side-bars, according to the Brill practice for several years past. The company also exhibits here one of its No. 27 high-speed trucks.

To show the other patterns of cars manufactured by it the Brill Company has out a large stand containing quite a number of miscellaneous photographs of cars and trucks, the stand being arranged for easy access in order that the public may examine the different types of rolling stock which the company has recently furnished throughout the world. The whole exhibit, which is one of the largest of the American exhibits at the Paris Exposition, covers a space 100 ft. x 10 ft.

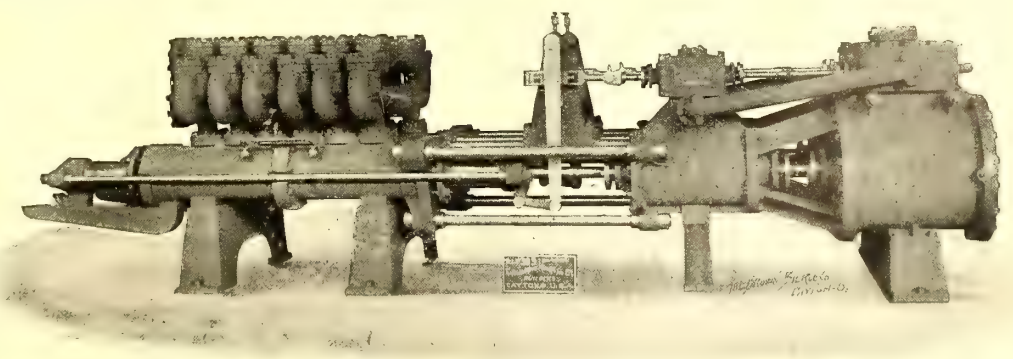
As this issue goes to press a cable dispatch states that the Brill Company was awarded, by the official jury, two grand prizes, one for its system of trucks, the other for its convertible cars. These are said to have been the only grand prizes awarded for electric trucks or convertible cars.

A New Design for a Compound Duplex Pressure Pump

The accompanying illustration shows a new compound duplex pressure pump to develop a maximum pressure of 700 lbs. per sq. in. manufactured by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio.

The liquid end is of the end-packed trombone style. The cylinders are made of special metal; mounted thereupon are separate chambers for the location of the valves. The chambers are also constructed of special metal and designed with a view of facilitating quick access for the inspection of the valves.

The valves are of the hydraulic pattern, made of steel, and guided from below. An extension piece is provided for supporting the water plunger, and an approved adjustment device provided therefor.

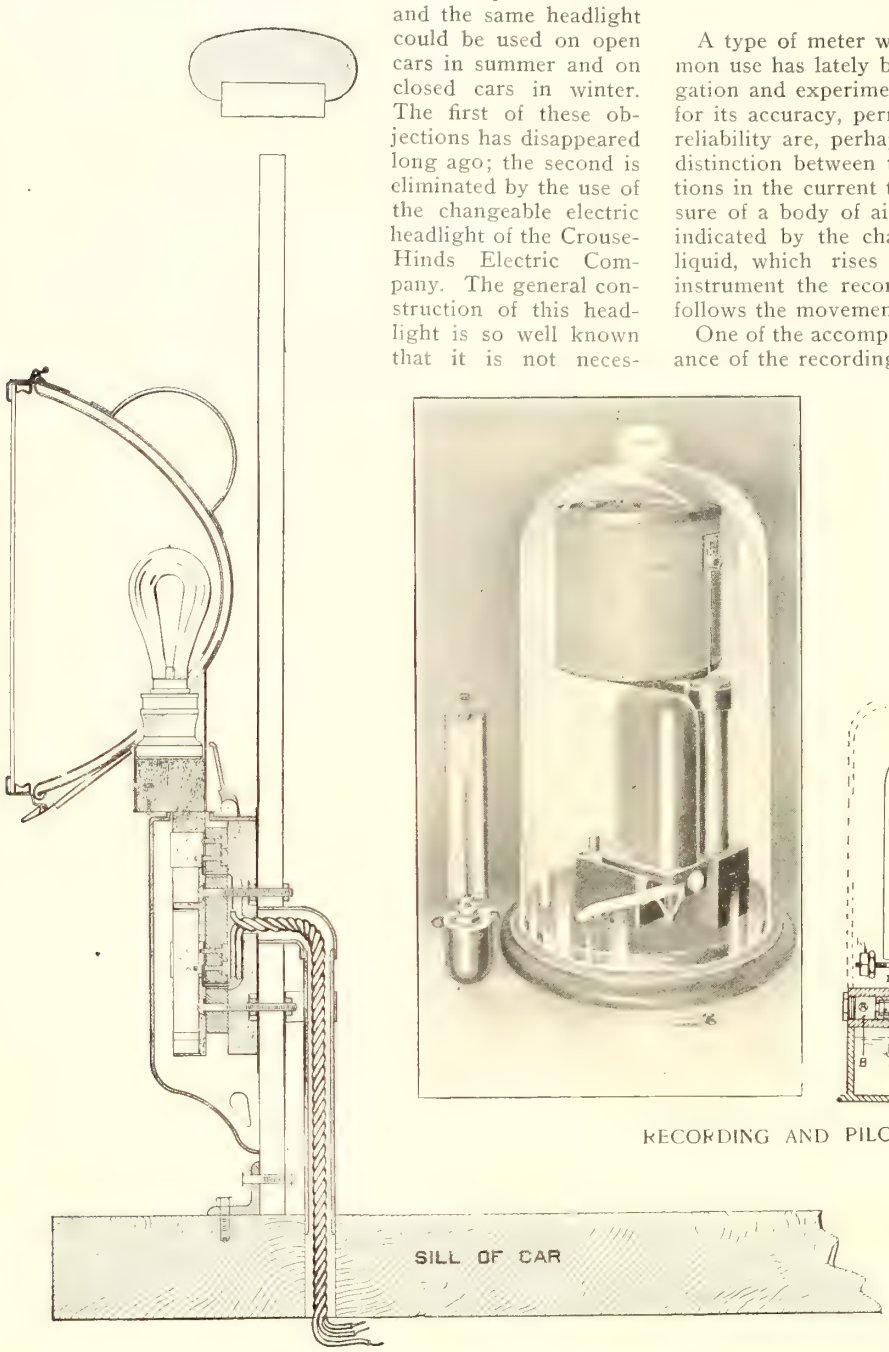


COMPOUND DUPLEX PRESSURE PUMP

The water end is mounted on heavy supporting columns. An engine of the transposed cylinder type is furnished, giving free access to all steam pistons without dismantling the pump. The outside valve adjustment is a feature of this design.

Changeable Electric Headlight

When electric cars were first introduced, electric lamps were, of course, used for the interior illumination of the car, but oil was employed exclusively for headlight purposes. The reason for this was probably two-fold; one was that the electric light was not considered reliable enough for headlight service, where the safety of the passengers, as well as that of persons crossing the track, is dependent to such a great extent upon the burning of the headlight at all times; the other reason was undoubtedly the fact that the oil headlight could be changed from one end of the car to the other so that a double equipment was not necessary for each car and the same headlight could be used on open cars in summer and on closed cars in winter. The first of these objections has disappeared long ago; the second is eliminated by the use of the changeable electric headlight of the Crouse-Hinds Electric Company. The general construction of this headlight is so well known that it is not necessary to discuss it here. The company has made a few changes in detail, however, during the last year, which have increased the convenience and reliability of the device. A section of the headlight, showing the construction of the receptacle as now built, is shown herewith. The receptacle, of course, is attached to each dasher, and the contacts form part of the light circuit of the car. One headlight only is required for each car in operation, and by placing this light in one of the receptacles, the lamp is automatically thrown into circuit, cutting out the lamp over the front platform. When the headlight is changed to the other platform the lamp cut out is thrown into circuit again, and the other platform light is cut out.



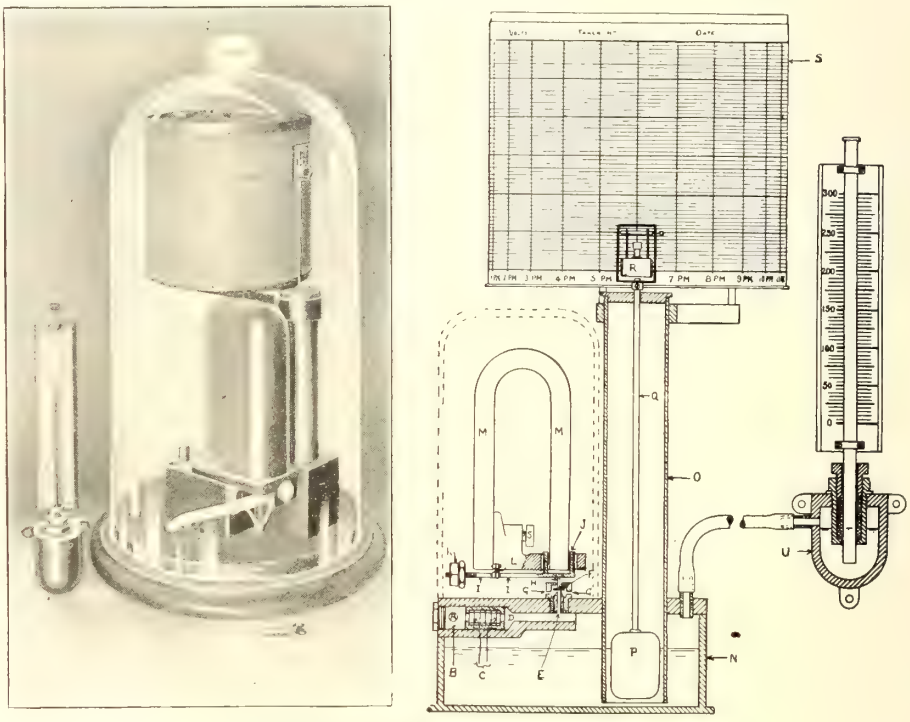
SECTION SHOWING HEADLIGHT AND RECEPTACLE

The contact stem of the headlight is made of second-growth hickory, kiln-dried and boiled in paraffin to make it thoroughly waterproof; the receptacles, which are mounted at each end of the car, are made with a kiln-dried oak back, having mounted thereon a ½-in. slate block. The brass connections of the receptacles are mounted on this base, and the contact springs are made of phosphor bronze. The receptacle is encased in a cast-iron backing 10 ins. high x 4 ins. wide. The wires are carried through the dasher in a small iron pipe. The opening of the receptacle not in use is protected by a cast-iron lid, which drops in place when the headlight is removed, making it water-tight.

A New Recording Meter

A type of meter which differs greatly from those now in common use has lately been brought out. Much painstaking investigation and experiment have been expended on it, and the claims for its accuracy, permanence, compactness, legibility and general reliability are, perhaps, not too strongly expressed. The radical distinction between this and the ordinary type is that the variations in the current to be measured control the variation in pressure of a body of air in a closed vessel. This latter variation is indicated by the change in height of a column of non-volatile liquid, which rises and falls in a tube. In the recording instrument the record is traced by a float-supported pen which follows the movements of the liquid's surface.

One of the accompanying illustrations shows the general appearance of the recording meter, and a small "pilot" indicator, which



RECORDING AND PILOT INSTRUMENT

can be placed in any desired position. The other illustration gives a section of the apparatus showing its operation. Air is supplied either from a small air pump furnished with the instrument, or from some other source, at a pressure of about 1¾ lbs. per square inch to the orifice, *A*, in the chamber, *B*. The air then flows through a series of porous diaphragms made of filter paper, whose prime function is to serve as an air resistance, but incidentally remove any dust particles and serve to make the instrument dead beat, and then enters the passage, *D*, into which is drilled the opening, *E*, which is capped by the valve, *F*. The valve itself consists simply of a small flat disc of non-oxidizable metal, *F*, resting on a circular seat with escape ports, *G*, below it, and a pin, *H*, resting on top. On the pin rests a spool, *J*, carried by one end of the lever, *I*, on the other end of which is a counter-weight, *K*, by means of which the effective weight on the pin, *H*, can be adjusted. The spool is wound with wire through which the current to be measured is passed, this being done by means of the two short thin copper ligaments, *L*, which support and form the fulcrum about which the lever can oscillate. A magnet, *M*, furnishes a field of force such that the reaction between it and the current forces the

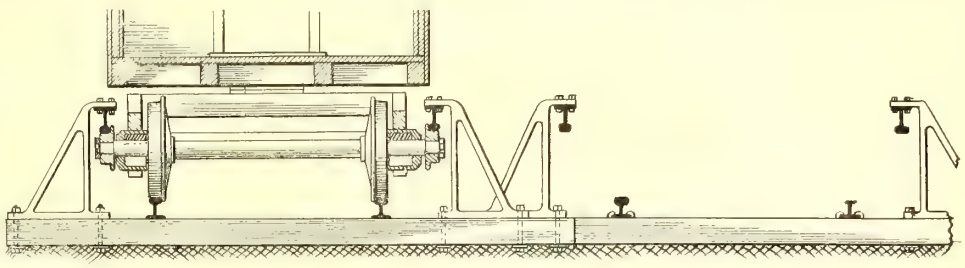
spool down with a force increasing as the current increases. The valve, *F*, is thus a variably loaded safety-valve, whose blowing-off point is constantly and proportionately varied by the current variation. The counter-weight, *K*, on the lever is so adjusted that when no current is passing through the spool the weight on the valve-pin is such that the blowing-off pressure in *D* is one sufficient to force the liquid in the closed chamber to such a height that the pin will register zero and the liquid in *U* will be forced to the zero position on the scale. The pressure cannot go above this when no current is on, as any tendency to increase simply results in lifting the valve slightly higher, whereupon more air escapes and the pressure falls back; nor can it go lower, as if there were this tendency the valve would partially close because of the spool weight, and the less rapid escape of air through it would cause the pressure to build up again because of the constant flow of air from the high-pressure supply at *A* through the air resistance, *C*. It is thus seen that the air pump must not necessarily keep a constant pressure on the opening, *A*. Exactly the same thing holds good when the weight on the valve is that due to the non-counterbalanced portion of the spool weight plus the downward thrust caused by a given current through it. This gives what is practically a heavier loaded safety-valve, so that the blowing-off pressure in *N* is higher, and this higher pressure, of course, forces the liquid up further, thus showing the presence of a current. The height to which the liquid rises is directly a measure of that current, because the extra downward thrust on the spool is, from the magnetic field and spool design, proportionate to the current.

It should be noted that the only work that the varying current has to perform is to *control* the air pressure, the actual energy required to move the liquid, and so show the variation, being supplied by an independent source, whose power is, comparatively speaking, unlimited.

The "column" instruments, described above, are being manufactured by the Whitney Electrical Instrument Company, and introduced by Machado & Roller, of 203 Broadway, New York City. A plain indicating instrument having a vertical scale like the pilot indicator, but extending 18 ins. between the zero and maximum readings, as well as a type of meters to be used on alternating currents, are also constructed.

A Device to Prevent Derailment

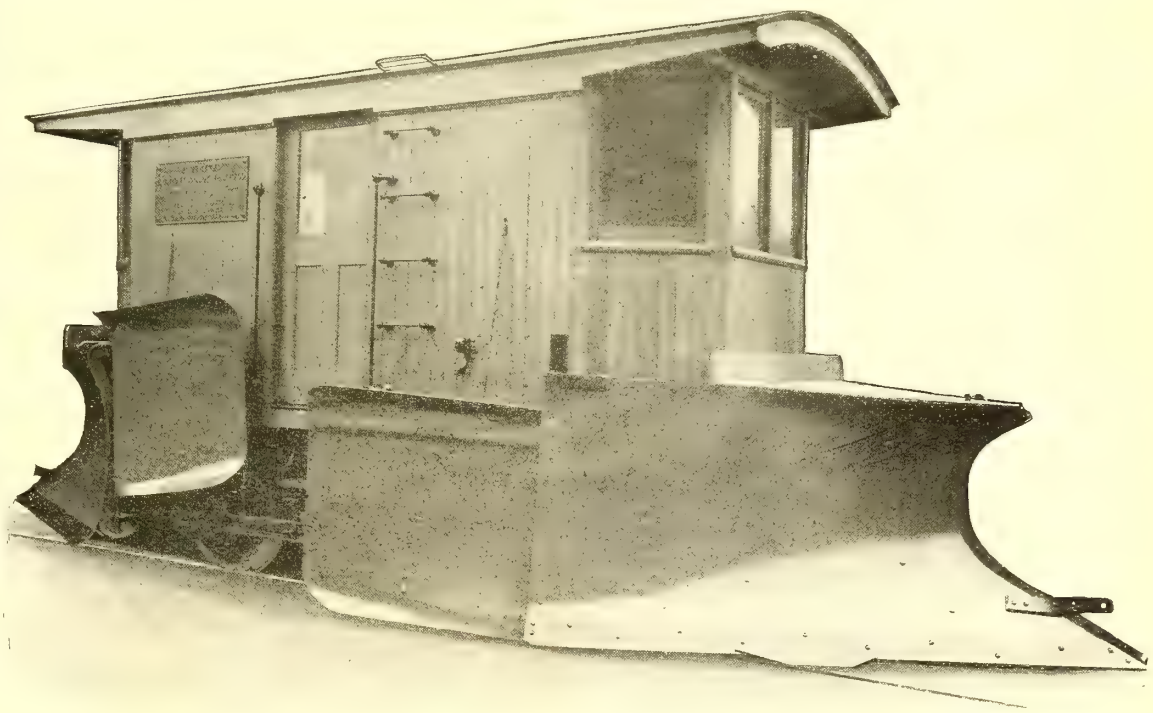
The accompanying illustration gives a good idea of a new system of track construction whereby it is claimed high speeds may be obtained without fear of derailing the cars. As seen from the figure, there is no material variation from the standard roadbed and rolling stock of the present day. The only difference in the roadbed is that for about every fourth tie one somewhat longer is substituted, on which to fasten the brackets for the support of the safety rails. These consist of ordinary T-rails turned upside down and bolted securely to the brackets, thus, if anything, increasing the stiffness of the roadbed. The car axles, instead of terminating in the grease-box, are extended until they project out under the inverted safety rails, and are provided with a small anti-friction roller at their extremities, which travels along those rails. By having this roller insulated from the axle and using a contact shoe on each side of the car, the safety rails may be insulated and used as the two sides of a trolley circuit, and the cars run electrically. This would be, of course, the probable form of power for high-speed service. The inventor of the system is W. T. Van Dorn, of Chicago, manufacturer of the Van Dorn automatic car coupler.



DEVICE FOR PREVENTING DERAILMENT

A Powerful Snow Plow

The new 1901 snow plow of the Taunton Locomotive Manufacturing Company differs in a number of particulars from the company's 1900 model. It weighs 5 tons without motors, and is thus somewhat lighter than the Taunton standard plow of last year. This reduction in weight has been secured entirely by dispensing with cast iron, especially in the shape of the two heavy counterbalance weights. The manufacturers have also substituted wrought iron and timbering for a large amount of cast iron used in last year's plow, and the noses are now raised and lowered by a chain, operated by worm and gear mechanism. The whole weight of the nose rests on the rail, although the height of the nose can be adjusted to suit any condition. This renders the plow especially valuable in light snows, and guarantees a clean rail under these circumstances. At the same time the shape of the nose and heavy oaken backing give sufficient strength for heavy drift work.



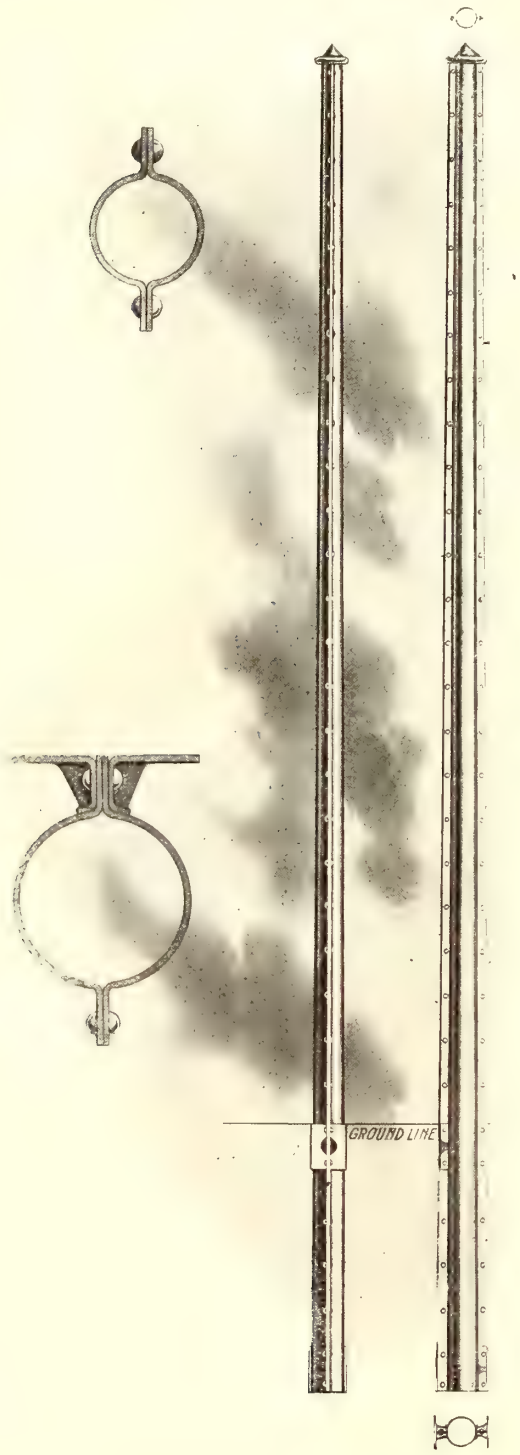
A POWERFUL SNOW PLOW

The wings are also a departure from former Taunton practice, and are believed to be an improvement, inasmuch as they dispense with the wing hinge pin, always difficult to keep in shape, when the plow is sent against frozen ground or hummocks of ice. The nose is carried so far back on each side that the wheels are thoroughly protected, and the sides of the plow are also protected from snow without in the least interfering with accessibility to the running gear. The hood or overhang part of the roof has been practically taken away to make perfectly easy the manipulation of the trolley rope. The effective Taunton digger is applied to this plow, and, as now built, the manufacturers, who have had many years of experience in electric plow building, state that they can see no opportunity for further improvement in a plow for all-round single track work. The changes made this year, as stated, are not in design, but are mainly in the substitution of timber and

wrought iron in place of cast iron. For ordinary work the excessive weight is not often necessary. For the heaviest kind of drift work, such as is met in Maine and Canada, however, the company makes the Taunton heavy-nose plow, which weighs twice as much as the plow described above.

A New Steel Trolley Pole

A trolley pole which differs in many important respects from the ordinary ones now on the market has recently been brought

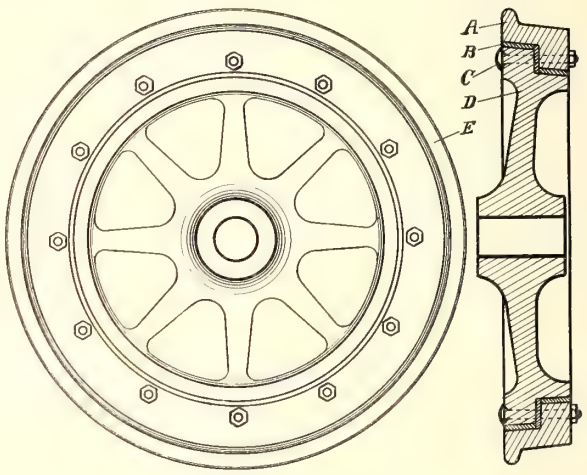


SECTIONAL TROLLEY POLE

out by the Pressed Steel Car Company, of Pittsburgh, Pa. The accompanying engraving presents a good idea of the general appearance of the pressed steel poles, sectional views being given to aid the reader's understanding of its construction. The new style is made in two semicircular sections, so firmly riveted together that they become practically one piece. Thus a maximum standard of strength is established throughout its entire length, and the occasional uncertainty which accompanies the use of poles having two or more longitudinal sections is eliminated. Brackets of a form shown in the illustration are placed on the flanges of the pole at the ground line and at the base, which give additional rigidity. The manufacturers claim that a pole of this kind can be made more cheaply than a tubular pole, and have prepared dies which enable them to turn out any size from 24 ft. to 40 ft. A malleable or cast-iron cap covers the top of the pole, which gives an artistic finish to its handsome appearance.

A Noiseless Car Wheel

The introduction of 2 or 3 lbs. of paper beneath the tire of a car has been tried with marked success in Chicago. Four wheels made in the manner shown in the accompanying sketch have been in operation for some time on a street car, and a similar equipment is being tried by one of the steam roads. This new style of



NOISELESS CAR WHEEL

wheel is the invention of I. Hogeland, of Chicago, who claims that by its use a sufficient recoil or cushion is obtained to render steel tires unnecessary, even for heavy steam railroad practice. The wheels were made by the Wells & French Car & Wheel Company. The tests are being made under the severest conditions, the street car on which the wheels have been placed running over some of the worst track in Chicago, so that the satisfactory operation of the invention under less trying circumstances is assured.

New Method of Hardening Steel

The Bethlehem Steel Company has recently perfected a new method of hardening steel, which is particularly adapted to tool steel. This process, which is called the Taylor-White process, has been employed in the Bethlehem works with remarkable results, and has enabled the company to speed up its main lines of shaft from 90 to 250 r. p. m. and greatly to increase the output of its machine shops.

One virtue of the Taylor-White process is that it gives to the steel the very valuable and exceptional property of retaining a high degree of hardness when heated to a visible red heat. It is possible with one of these tools to cut steel at a speed so great as to heat up the point of the tool to redness and have it continue to cut for several minutes at this speed, leaving an unusually smooth finish on the work, as well as cutting accurately to size. The advantage in leaving a smooth roughing cut and of having the work accurately to size will be readily appreciated, as it materially lessens the work of finishing. The practical speeds at which these tools will run has been found to be from two to four times that of any steel with which the company has experimented, and it has endeavored to obtain the best in the market. The effect of the Taylor-White process, which is applied after the tool has been dressed or machined to shape, penetrates to the center of the steel, even in the largest tools ever treated, i. e., 4 ins. square.

All of the standard brands of self-hardening steel which have been experimented with are improved to a more or less extent by the treatment; it is preferred, however, to use a steel of special composition in order to get the greatest uniformity and maximum results. This special steel forges so much more readily than the general run of self-hardening steels that tools of difficult shapes may easily be made up.

The company has also discovered a simple and comparatively rapid method of annealing this special steel by which tools may

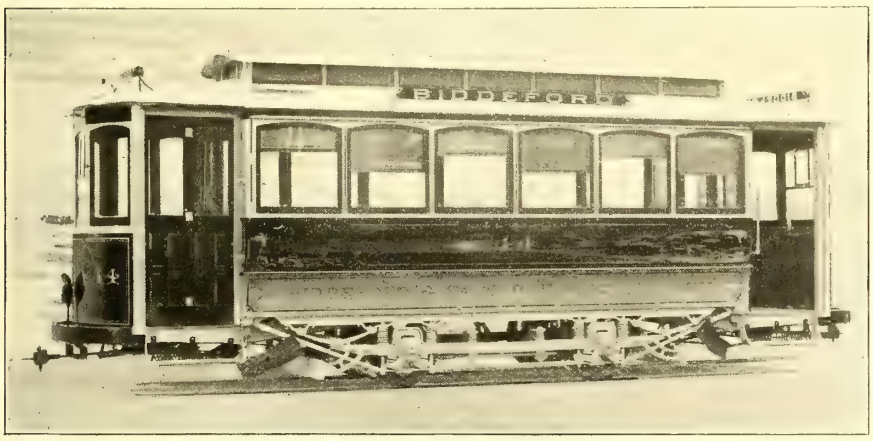
be easily machined to shape, making it applicable to twist drills, chasers, inserted cutters, etc., which have heretofore not been made from self-hardening steel.

A very important feature resulting from the use of this process is that the tools are extremely uniform in quality, so that work on which they are used can be regularly performed at the maximum rate of speed. The variation in the quality of these tools does not run over 5 per cent, which insures a much greater degree of uniformity than is attained in any other tools that we know of, whether made either of tempered or any air-hardening steel. With uniform tools the piece-work system can be most efficiently used, as the piece rate must always be based not on the average cutting speed of the tools, but on the speed of the worst tool in use.

The company proposes to sell shop rights to use this process, the price to be based upon the number of tools in use, as well as their size and character.

Car for Cold Climate

The type of car shown in the accompanying engraving is one which has been found useful and satisfactory for suburban lines



CLOSED CAR FOR BIDDEFORD

in very cold and trying climates. The car in question was built by the J. G. Brill Company for the Portland Railroad Company to be operated on the Biddeford & Saco line. The body is 18 ft. long and is mounted on No. 21-E trucks, furnished with two motors. The platforms are 4 ft. 6 ins. long with so-called circular ends. They are completely enclosed, having folding doors which turn back against the body of the car. This gives complete protection to both motorman and conductor, a feature highly necessary in a climate where the thermometer often drops below zero and where high, piercing winds are the rule during the winter. The cars measure 27 ft. over all and are 6 ft. 2 ins. at the sills and 7 ft. 6 ins. over all. Looking at the engraving it will be noticed that scrapers are fitted at each end of the car. These attachments are almost equivalent to a snow plow, and enable the car to run through light snow and even move the small but annoying drifts which are common on some parts of the line. Scrapers could be more frequently used to advantage, as they prevent many delays in winter operation, which are both annoying and costly. The ends of the car are fitted with Brill angle-iron bumpers, sand-boxes, Dedenda gongs and electric headlights. The track is standard gage, 4 ft. 8½ ins. The wheel base is 7 ft., thus securing great steadiness of motion and enabling a high speed to be maintained with comfort. The car measures 12 ft. from the head of the rail over the trolley board.

The finish over the windows inside is of mahogany, the sashes are of mahogany with arched tops, and the head lining is of three-ply quartered oak. Four-sided reversible signs are placed on the sides and ends of the car. The trim throughout is solid bronze. The total weight of the car without motors is 11,800 lbs. The seats are longitudinal, with spring seats and backs covered with crimson plush. Cars of this general type are easily heated and the practice is fairly divided between electric heaters and stoves.

Nelson C. Draper has been appointed superintendent of the Peoria & Pekin Terminal Railway Company, of Peoria, Ill., to succeed Mark H. Hubbell, resigned. Mr. Draper has been connected with this road for some time as electrical engineer, and was formerly connected with the Central Railway Company, of Peoria.

A New Incorporation

Messrs. Fowler and Robert, comprising the firm of Fowler & Robert, the organization of which was announced in the STREET RAILWAY JOURNAL a few months ago, have found their business as manufacturers and dealers in general railway supplies has increased so rapidly as to call for a large extension of their facilities. For this reason, they have organized a company, which will be known as the Fowler & Robert Manufacturing Company, have secured good-sized works at 1263 Atlantic Avenue, Brooklyn, and have enlarged their field and personnel. The latter is now extremely strong, and includes not only Messrs. Fowler and Robert, who are well known in the street railway field, but also George W. Linch, for a long time superintendent of the Dry Dock, East Broadway & Battery Railway Company, in New York City, and Fred Vieweg, as well as others. The company is prepared to supply all the specialties formerly made by the Lewis & Fowler Manufacturing Company and the Brooklyn Railway Supply Company, and will make a specialty of the L. & F. improved fare register. This register, which is the former Lewis & Fowler, but in which have been embodied a number of important improvements, has stood the test of service for twenty years, and is one of the earliest and best known in the field. The new company believes that now that these registers will be manufactured and supplied by the same persons who were instrumental in its original design and manufacture, and now that repair parts for it can easily be secured, the machine will be received with all its former popularity. In addition, the company will manufacture repair parts for L. & F. electric snow sweepers and car heaters, and will manufacture, or has secured the agencies for, all kinds of car trimmings, bells, gongs, brake-shoes, bearings, special track work, trolley wheels and harps, commutators, canopy switches, etc., as well as the Thistle brand of metallic paints. The New York office remains at 149 Broadway.

New Publications

Horseless Vehicles, Automobiles and Motor Cycles. By Gardner D. Hiscox. Published by Norman W. Henley & Company, New York City. 459 pages. Illustrated. Price, $3.

In this book the author again exhibits his faculty of practical discrimination. From the immense field offered by the present state of automobile manufacture he has made most happy selections, and compiled a series of illustrated descriptions of steam, internal combustion, compressed air and electrical vehicles, which cannot fail to prove of service to those interested either in their production or operation. As is natural in books of this kind, unlimited use has been made of patent drawings, illustrations from trade catalogues, etc., but as they admirably serve their intended purpose no fault can be found with their introduction. The first two chapters contain many interesting facts concerning the utility and history, and considerable space is given to the running, care and repair of automobiles, but the greater part of the volume is devoted to the various styles which the author has chosen to describe.

Gas-Engine Construction. By Henry V. A. Parsell, Jr., and Arthur J. Weed. Published by Norman W. Henley & Company, New York City. 296 pages. Illustrated. Price, $2.50.

The amateur mechanic who is interested in gas engines will find much information in this volume. After thirty-eight pages of rather meager description of the various types and some commercial forms, the author devotes nearly the entire remainder of the book to the manufacture of a ½-hp engine. Starting at the patterns, instructions are given in great detail for every operation until the work is completed. The book is uniquely illustrated by reproductions of photographs taken during the actual construction of such an engine by the author, as well as the ordinary working drawings. A feature which will, perhaps, make the book of interest to engineers is an annotated list of gas-engine books and periodicals published in the English language, with which it closes.

Corporations and Public Welfare. Published by McClure, Phillips & Company, New York. 208 pages. Price, $1.50.

This book contains a collection of addresses delivered at the annual meeting of the American Academy of Political and Social Science in Philadelphia in April. The volume contains many papers of interest to students of sociology, and the subject of municipal control receives quite a little attention.

CURRENT NEWS

Third Rail Attacked in Brooklyn

The Department of Public Buildings, Lighting and Supplies has begun an attack on the Brooklyn Rapid Transit Company, and has officially notified the company that it must either make the system absolutely safe or do away with it altogether on the elevated lines. This action is said to have been prompted, as officially put, "Because of the numerous serious accidents on the system since its installation," but is believed to be a similar political demonstration to that made against the Manhattan Company by Tammany Hall late last year.

Proposition for a Sub-Sidewalk Railway in Chicago

J. H. Farrar, of Chicago, has submitted plans and detailed explanations of a sub-sidewalk railway to the Street Railway Commission. The chief merits of the system are in the cost of construction and the high speed which may be attained. The scheme provides for the construction of the road directly under the sidewalk.

For use on the sub-sidewalk railway the inventor proposes an open car, resembling a carette with the top cut away. The sidewalk above furnishes the top for the car and prismatic walks above give light, aided by electric lights within. Heat is to be furnished from gas radiators along the curb.

Wire-Tapper Caught in Milwaukee

On Aug. 25 the engineer of two large Milwaukee buildings was arrested on the charge of stealing electricity from the Milwaukee Electric Railway & Light Company. Secret connections were made with the lighting lines of the company, and power was stolen for lighting both buildings. Superintendent Rau, of the Milwaukee Company, had his suspicions aroused, it is said, by the unusual hours at which lights were lighted in the building, and at once began an investigation, feeling certain that the plants in the building were not being operated at the unusual hours at which the lights were used. It is said that the case will be prosecuted to the bitter end and that an example will be made of the thief.

Reorganization in Elmira

A meeting was held last week of the Elmira Water, Light & Railroad Company, the new company in Elmira, at which officers were elected, and the company took over the property of the old Elmira Municipal Improvement Company. The latter has, for some time past, been in the hands of a reorganization committee, consisting of George W. Young, chairman; Walter G. Oakman, James C. Simpson and E. C. Jones. The new company owns and operates the water, gas and electric light properties in Elmira, as well as the former street railway property of the Municipal Improvement Company. The board of directors of the new company consists of Frank R. Ford, of New York, president; Charles F. Uebelacker, vice-president and general manager; John Alvin Young, H. M. Francis and Frank H. Davis. J. M. Diven is secretary and treasurer, and H. D. Benner is assistant secretary.

From Schenectady to Albany

The United Traction Company, of Albany, N. Y., and the Schnectady Railway Company have come to an understanding regarding the construction of an electric railway from Schenectady to Albany, and a company has just been incorporated to carry out the project. The company is known as the Albany & Schenectady Traction Company, and is capitalized at $100,000. The road will be built over the Schenectady turnpike. The company has been granted the right to operate over the lines of the United Traction Company to the heart of Albany. Following are the officers and directors of the company: Jesse H. Leonard, president; J. S. Klingelsmith, vice-president and general manager; C. D. Miller, secretary; Edward P. Williams, treasurer. Directors: Jesse H. Leonard, Edward P. Williams, C. D. Miller, T. Kerwin and J. S. Klingelsmith, of Albany; Charles Pfisger, of New York; B. B. Griffen and William Hay Bacus, of Saratoga Springs; G. G. Evertonson, Bath-on-the-Hudson.

Operating Changes in St. Louis

The St. Louis Transit Company is planning to make a number of important changes in the operating routes of its lines, and is now constructing a number of switches at different points in the city to permit making the changes. In the downtown district a number of switches are being constructed with a view to arranging loops at the eastern terminals of all the roads, and those in the west end are being constructed with a view of arranging new lines. The three most important changes will be made in the Olive Street, Channing Avenue and Southern Electric lines. The Olive Street line will be continued to Forsythe Junction, where connections will be made with the present road to Clayton; the Channing Avenue line will be a new division, and will run east from the city limits on Easton Avenue to Grand, south on Grand to Cook, east on Cook to Channing, south on Channing to Laclede and then east over the Laclede Avenue tracks on Market to Broadway; the northern terminus of the Southern electric line will be changed so as it will make a loop around Seventh, Morgan and Sixth Streets instead of going north as far as Howard Street, as at present.

Reorganization of the Chicago General Railway Company

The stockholders of the Chicago General Railway Company are in receipt of a letter outlining a plan for the reorganization of the company, which gives them permission to file, within a specified time, their holding of stock with the Real Estate Trust Company, of New York, in order to take advantage of a pending settlement and a sale of the property. Joseph P. Mahoney, William A. Goodman and Charles L. Bonney are named as a stockholders' committee, with full power to transfer and vote the stock at their discretion, and to represent all the stockholders, signing the agreement in the prospective sale of the company's property. It is said that more than $300,000 out of a total $500,000 stock issue have already been deposited with the New York Trust Company. The majority control is, therefore, already assured. This is one of the final steps taken by the Chicago General's reorganization committee to prevent a foreclosure sale under the present receivership proceedings and to protect the company's stockholders. The plan was drafted by the New York creditors of the company, who are opposed to allowing a foreclosure sale.

The fact that the Chicago General Company has valuable franchises from the city and that negotiations have several times been in progress for a transfer of these rights to the Chicago City Railway, is the basis for the new stockholders' agreement. It is reliably stated that a standing cash offer for a controlling majority of the stock is already in the new stockholders' committee's possession. Another committee representing the bondholders is also working on the same lines. This is composed of James P. Black and Lyman M. Paine, of Chicago, and Newbury D. Lawton, of New York. Practically all the outstanding bonds, except those deposited with the Merchants' Loan & Trust Company, of Chicago, and those in the possession of ex-President James H. Witbeck, have been deposited under a similar agreement with the Real Estate Trust Company in New York. The bondholders' interests are thus divided between the Merchants' Loan & Trust Company, which also represents the company's floating debt creditors; the Witbeck and King holdings, which are the subject of litigation in the courts, and the New York creditors. It is understood that an amicable settlement may soon be arranged, under which the three coteries of bondholders will pool their interests.

A Striking Advertisement

The Chicago Union Traction Company is now carrying a large advertising card in the press of that city, especially appealing to the G. A. R. guests, who are now in that city, and setting forth how Chicago may be seen for a dime. The advertisement is in large type, and is headed: "See Chicago for a Dime on the Trolley Car." In the left-hand upper corner of the card is a cut of a car well filled with G. A. R. delegates, showing in the background the outline of the great Ferris wheel, and dated Chicago, 1900, while in the left-hand lower corner is an outline picture showing

the troops on their triumphant return to Washington in 1865. The advertisement is divided into five paragraphs, each ending with the words, "ON THE TROLLEY CAR," in large type. The last paragraph ends with these words in especially large type stretching across the entire bottom of the card. The introductory words of each paragraph are in large type and are quite prominent. We reprint three of the paragraphs as they appear in the advertisement, to show how well written and forcible they are:

SPECIAL INVITATIONS are extended to the visitor this week to inspect Chicago and its suburbs and see the great changes that have taken place since the days of '61. This western town has fought its battles and won its victories until it stands to-day in the front rank of the great cities of the world. The things which make it great may be seen easily by all who are clever enough to look for them ON THE TROLLEY CAR.

ONE OF THE FORCES which has aided materially in the success of the city has been the trolley car—the great modern population distributer. The evolution from the old one-horse car of the sixties to the modern, double-truck, air-brake, electric-lighted creation of to-day, might call forth a repetition of Milton's sentiment: "Peace hath her victories no less renowned than war." The victories in the street-car field have resulted in placing the trolley car on the health-restoring, pleasure-giving list of modern inventions, so that now it is quite the proper thing to see the sights of the city, its suburbs, parks, groves, boulevards and outing resorts by going to them ON THE TROLLEY CAR.

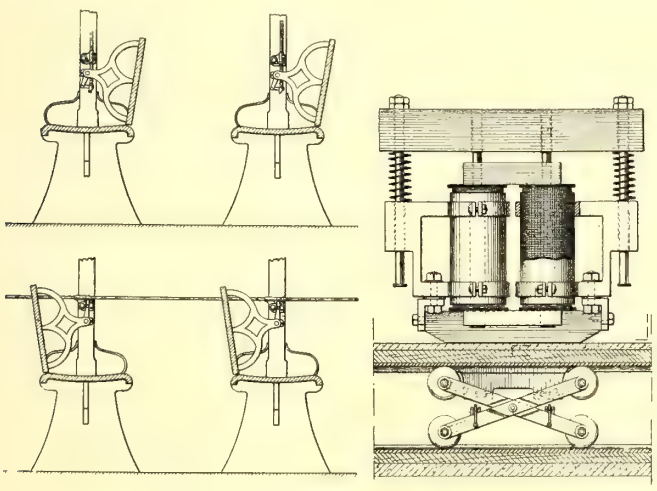
FOR SOCIAL PARTIES special trolley cars are in service going to any part of the city. There are many pleasant trips of this character around suburban Chicago, and this would be a delightful way to entertain one's friends. There are over 500 miles of tracks covered by the trolley cars in operation by the Union Traction Company on the north and west sides of town, and one may readily select a route covering a score of interesting points. If in doubt, address the general offices of the company, at 444 North Clark Street, Telephone North 736, and find out about where to go and how to get there ON THE TROLLEY CAR.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED AUG. 21, 1900

656,183. Gate for Open Cars; C. M. Fairbanks, Central Falls, R. I. App. filed April 18, 1900. Each seat is provided with two gates, one at each end, both of which are operated at the same time by the turning of the seat, the one opening and the other closing.



PATENTS NOS. 656,183 AND 656,511

656,188. Car Seat; H. S. Hale, Philadelphia, Pa. App. filed March 20, 1900. A construction providing for the lower edge of the back clearing the surface of the seat cushion when the back is shifted.

656,207. Trolley Wheel; H. A. Osborne, Plainville, Conn. App. filed Dec. 6, 1899. The flanges of the wheel are provided with cutting ribs to remove the ice from the wire.

656,219. Seat Structure; W. L. Schellenbach, Philadelphia, Pa. App. filed July 22, 1899. Gearing is arranged between the seat and the levers, which move the seat back, so that the back will be given a certain inclination when it is swung from one side to the other.

656,226. Rail-Joint; B. Sturenberg, Alfhausen, Germany. App. filed Feb. 6, 1900. The distinguishing feature is a double wedge-shaped fish-plate lying against the suitably tapered heads and webs of the rail.

656,276. Electric Railway System; L. E. Walkins, Springfield, Mass. App. filed Dec. 15, 1898. The pressure of the car wheel first throws the switch to close the circuit to the sectional conductor, the circuit being thereafter held closed by an electro-magnet, until the vehicle has passed.

656,372. Guard for Controller Brushes; A. L. Riker, New York, N. Y. App. filed Jan. 8, 1900. The guard prevents the controller brushes from catching upon the controller segments.

656,379. Brake; G. E. Seymour and F. Kahler, New Albany, Ind. App. filed June 7, 1900. The releasing device is a button on the end of the brake staff by pushing which an instantaneous release is affected without movement of the handle.

656,381. Anti-Vibrating Car Truck; L. C. Thompson and F. Kirk, Cuyahoga Falls and Akron, Ohio. App. filed Oct. 19, 1899. The invention relates to a pair of four-wheeled electric car trucks supporting the car upon the motor drive-wheels and bracing the guide wheel in a manner to receive the vibratory shock generated at the electric motors in connection with the motor armature, including the vibration generated by the rapid revolving motion of the car wheels.

656,445. Cooling Brakes; A. Ekstrom, Schenectady, N. Y. App. filed April 27, 1898. A piping system is arranged to deliver a cooling liquid against the brake shoes to reduce the temperature due to frequent use.

656,477. Auxiliary Car Mover; P. Ryan, New York, N. Y. App. filed Dec. 29, 1899. An eccentric on the axle vibrates a pusher-bar, which acts against the roadbed.

656,511. Electric Railway System; G. L. Campbell, New York, N. Y. App. filed Dec. 15, 1899. A trolley carrying an armature is dragged through a conduit by a magnet on the car. In moving along the trolley closes the circuit between the main and sectional conductor.

656,571. Controller for Electric Motor; T. S. Perkins, Idlewood, Pa. App. filed Jan. 13, 1900. In connection with the contact fingers one or more electro-magnets and arc shields are provided, with magnetic flux conductors, which project between adjacent fingers and into proximity to the pole pieces of the magnets for the purpose of preventing arcing.

656,608. Brake Mechanism; C. E. Moore, Chicago, Ill. App. filed Dec. 23, 1899. The combination with a brake-shoe head, of a hanger for suspending or supporting the same, provided with a ball-and-socket connection between said hanger and brake shoe and a ball-and-socket connection at the upper end of said hanger between the same and the truck frame, each of said ball-and-socket connections comprising a ball and a two-part socket surrounding the ball.

PERSONAL MENTION

MR. H. J. McGOWAN, president of the Indianapolis Street Railway Company, of Indianapolis, Ind., has been elected president of the Kansas City Gas Company, of Kansas City.

MR. A. J. PURINTON, of Waterbury, Conn., has been elected general manager of the Palmer & Munson Street Railway Company, of Palmer, Mass., to succeed Mr. D. F. Burritt. Mr. Purinton will also have charge of the plant of the Central Massachusetts Electric Company.

MR. HERBERT W. SMITH has accepted a position with the Stuart-Howland Company, of 283 Devonshire Street, Boston, as assistant manager of its railway department. Mr. Smith's extensive experience in the street railway supply business well fits him for his new duties.

MR. F. I. BROWN has been elected president of the Jacksonville Street Railway Company, of Jacksonville, Fla., to succeed Mr. D. F. Jack. Mr. Jack resigned because of the pressure of his duties as general traffic manager of the Plant system. Mr. Brown is also president of the Main Street Railroad Company, of Jacksonville, and the supervision of both systems will thus be brought under one head.

MR. HENRY S. NEWTON has resigned as manager and purchasing agent of the Syracuse, Lakeside & Baldwinsville Railway, of Syracuse, N. Y., to accept the position of general superintendent of the Beaver Valley Traction Company, of Beaver Falls, Pa. Mr. Newton has previously been connected with the Consolidated Street Railway Company, of Wheeling, W. Va.; the Syracuse Street Railroad Company, and the Syracuse Rapid Transit Company.

MR. T. B. GOODYER, general traffic superintendent; Mr. H. M. Sayers, power engineer, and Mr. J. A. Lycett, district superintendent of the British Electric Traction Company, of London, England, who are now studying American electric railway practice, were in Buffalo Aug. 20. Messrs. Goodyer, Sayers and Lycett inspected the lines of the International Traction Company and expressed themselves as well pleased with the system. It is their purpose to visit Toronto, and then go to New York. They will sail for London about Sept. 1.

NEWS NOTES

WASHINGTON, D. C.—The assistant attorney for the district has forwarded to the Commissioners an opinion holding that passengers of the Brightwood Railway Company are not entitled to free transfers to the Metropolitan Railroad Company, and that the act of Feb. 26, 1895, authorizing and requiring the Brightwood Company to sell four coupon tickets for 25 cents, good for one continuous ride in the District of Columbia over the lines of the said company and the lines of the Metropolitan Railroad Company, is still in force. For the past five or six months passengers on the Brightwood road have been given free transfers at the terminus of that road for a continuous ride over the line of the Metropolitan Railroad Company. Under an arrangement announced by the Washington Traction & Electric Company these free transfers will be discontinued on Sept. 1, and passengers desiring to transfer to the Metropolitan line will be required to use a four-for-a-quarter ticket good for one continuous ride in the District of Columbia over the line of the Brightwood and Metropolitan roads, or pay cash fares.

CHICAGO, ILL.—Coal is to be substituted for oil as fuel in the Western Avenue, Hobbie Street and Rockwell Street power houses of the Union Traction Company. The plants are being fitted with automatic stokers in preparation for the change. Economy is given as the reason for the change.

PALMER, MASS.—The Palmer & Monson Street Railway Company has accepted the franchise recently granted it by the Council of Wilbraham.

NEW BRUNSWICK, N. J.—A car of the Middlesex & Somerset Traction Company ran into a freight train on the Raritan River Railroad, Aug. 20. Seven passengers, who were on the car, escaped injury by jumping from the car. The motorman and conductor remained at their posts, and both were shaken up badly.

ROCHESTER, N. Y.—Twelve persons were injured, one mortally, and forty others were in danger through an accident on the Manitou Beach Railroad at Greenway's Bluff, near Charlotte, on Aug. 24. A crowded car was derailed by the breaking of a flange, and it plunged into a gully 15 ft. below.

CLEVELAND, OHIO.—A car on the Cleveland & Chagrin Falls Electric Railway jumped the track on a curve near Chagrin Falls Aug. 22, while running at high speed. The car was wrecked and the crew and twelve passengers cut and bruised. Five persons were seriously injured.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company is receiving the first of a lot of fifty double-truck cars ordered some time ago from the J. G. Brill Company, of Philadelphia. In the near future all lines operated by the company will have been equipped with these cars.

COLUMBUS, OHIO.—The employees of the Columbus Railway Company were given their fourth annual outing at Olentangy Park a few days ago. Twenty-three hundred metal badges were issued to the families of employees, furnishing free transportation and admission to the park and all entertainments to the holders. The car crews were arranged in shifts so that every employee was given a chance to participate in the festivities.

COLUMBUS, OHIO.—The Urbana, Mechanicsburg & Columbus Electric Railway Company has presented a proposition to the city for a franchise on certain city streets. The company agrees to carry passengers at the rate of 5 cents for single fare, seven tickets for 25 cents and twenty-eight tickets for $1, the fare to Urbana not to exceed 2 cents per mile. A bond for $1,000, with approved security, accompanied the proposition.

BEAVER FALLS, PA.—On Aug. 24 a closed car of the Beaver Valley Traction Company jumped the track on a steep grade, overturned and plunged into two trees, where it hung suspended 150 ft. above the Fort Wayne Railroad tracks. There were about fifty passengers on the car, many of whom were injured.

RICHMOND, VA.—The Richmond Passenger & Power Company and the Richmond Traction Company have practically agreed upon a system of general transfers, covering all the lines in Richmond and Manchester.

SEATTLE, WASH.—The Supreme Court has just handed down a decision ordering that the temporary injunction restraining the Seattle Electric Company from proceeding with certain improvements in its system, as authorized in the franchise grant to J. D. Lowman and Jacob Furth, dated March 8, be dissolved. The effect of the decision is that the ordinance granting the franchise does not violate any of the provisions of the charter of the city of Seattle, and the procedure adopted by the City Council in passing the ordinance is in substantial compliance with the procedure marked out in the charter. As an immediate result of the decision, it is said the plans of the Seattle Electric Company, for which the franchise was secured, will be put into operation, involving substantial and costly repairs to existing lines of street railway controlled by the company, the reduction of fares, the inauguration of a complete transfer system and the early commencement of work on many miles of extensions.

CONSTRUCTION NOTES

SAN BERNARDINO, CAL.—The Board of City Trustees have granted Judge J. L. Campbell a franchise for constructing and operating an electric railway over a specified route here. James H. Boyd is associate with Judge Campbell in the promotion of the enterprise.

NEW BRITAIN, CONN.—The Connecticut Lighting & Power Company only awaits the action of the Legislature before beginning work on its new line from Lazy Lane to Waterbury. With a line to Waterbury the Connecticut Lighting & Power Company will have a direct route from Hartford to Waterbury.

MERIDEN, CONN.—The directors of the Meriden, Southington & Compounce Tramway Company have voted to extend the company's lines through Cheshire to Waterbury, a distance of 15 miles. The Legislature will be petitioned at its coming session to allow the extension. When the line is built four leading cities of Southern Connecticut—New Haven, Waterbury, Meriden and Bridgeport—will be connected by trolley. The connection between New Haven with Waterbury and Meriden will be made at Cheshire, as the Fair Haven & Westville line has voted to extend its line from Mount Carmel to Cheshire, to connect there with the Meriden and Waterbury line which is planned. When the proposed extensions are built complete trolley line will be established between Hartford and Bridgeport, a distance of 53 miles.

JUNCTION CITY, KAN.—The City Council has granted Frank V. Crouch, of Carrollton, Mo., a franchise for the construction of an electric railway here. Mr. Crouch has announced that he has financial backing to the amount of $500,000, and that it is the purpose of the promoters to also erect a power plant with a capacity for furnishing light and power for industrial purposes in both Junction City and Fort Riley.

LEXINGTON, MASS.—The Lexington & Boston Street Railway Company has completed and placed in operation its extension from Bedford to Concord.

WASHINGTON, D. C.—The Council of Rockville, Md., has at last ratified the ordinance granting the Washington & Rockville Electric Railway Company a franchise in Rockville. The work of surveying for the new line has begun, and it is announced cars will be in operation in a very short time.

BOSTON, MASS.—The Boston Elevated Railway Company has just been granted a permit for the erection of a large car house on the south side of the Charles River. The new house is to be of brick and wood, and will be 506 ft. long, 34 ft. wide at one end and 71 ft. at the other. The storage capacity of the house will be 250 cars. There will be rooms for the motormen and conductors, offices, waiting room, lunch room and all conveniences. The cost of the building will be about $65,000.

LYNN, MASS.—The Lynn & Boston Railroad Company will shortly apply to the Council for franchises for the extension of its lines in two parts of Lynn. One of the locations desired is on Western Avenue at the intersection of that thoroughfare with Eastern Avenue, and provides for the continuation of the belt line over the Salem and Boston Turnpike, with a double track to the dividing line between Lynn and Salem. Another extension for which permission will be asked is from the intersection of Eastern and Western Avenues and the Salem and Boston Turnpike to Washington Street, parallel to the track now laid. The Council of Salem will also be petitioned by the company for permission to extend its lines from the dividing line between the two cities to the business section of Salem. The laying of these tracks, it is thought, would prove of great convenience to the traveling public between the two cities.

ST. LOUIS, MO.—The St. Louis County Court has granted the St. Louis & Suburban Railway Company, of St. Louis, Mo., permission to construct a track across Carson road near the city limits of Ferguson, and to cross and run over the Florissant Rock road for a short distance, forming part of a new line to Ramona Park, where connection will be made with the Florissant division to Ferguson. Practically the entire route, over 2 miles, will be over a private right of way.

LARCHMONT, N. Y.—The Larchmont Horse Railway Company has completed and placed in operation its extension from Larchmont Manor to Port Chester. On the west the line connects with the Union Railway for New York, making it possible to ride by trolley from extreme southerly end of New York City to the Connecticut State line, a distance of 32 miles.

MOUNT VERNON, N. Y.—The New York, Westchester & Connecticut Traction Company has commenced the construction of its line over the White Plains road in Bronxville, as provided for by a franchise recently granted by the village trustees. This line is a continuation of the North Mount Vernon line, of Mt. Vernon, and ultimately, it is expected, will be extended to White Plains, a distance of 8 miles.

JERSEY CITY, N. J.—The North Jersey Street Railway Company is now securing the consents of property owners for the extension of its lines in the Orange Valley. The new line will probably be a continuation of the present Central Avenue Road, which ends at Fourteenth Street. The new line will run from Fourteenth Street west on Central Avenue, through East Orange, Orange, Centre Street, Orange, to Tremont Avenue, and westerly through the Orange Valley, a thickly populated section needing trolley accommodation.

CINCINNATI, OHIO.—The Millcreek Valley Electric Railway Company has purchased a tract of land at Hartwell on which to erect a new car house and power house. It is estimated that this improvement will cost $125,000. The company will rush work on its Glendale extension, and expects to have the line completed by Oct. 1. Next spring the road will be extended to Hamilton. This branch will run over the Carthage pike to the intersection of Spring Grove Avenue, at St. Bernard; thence along Spring Grove Avenue to Chester Park, where it will connect with the Consolidated line, thus giving a direct line from Hamilton to Fountain Square, passing through the villages of Glendale, Wyoming, Lockland, Reading, Hartwell, Carthage, Elmwood Place and St. Bernard.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week in order to secure insertion in the current issue.

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Consolidation of Southern Jersey Companies

On Sept. 1 the consolidation of the Camden Gas Light Company, Camden Gas & Fuel Company, Camden & Burlington Gas & Electric Company, East Side Gas Company, the Gloucester Electric Company, the Consumers' Gas Company, of Woodbury, Woodbury Electric Light & Power Company, and the Camden, Gloucester & Woodbury Electric Railway Company was completed as the South Jersey Gas, Light & Traction Company. Among those interested in the new company are: Anthony Kuser, Thomas N. McCarter, Jr., David Beard, William J. Thompson, John J. Burleigh and Charles H. Watson.

Sale of Fort Worth Roads

The sale of the City Railway and the Fort Worth Street Railway, of Fort Worth, Texas, to the Coffenberry-Bishop syndicate, of Cleveland, O., is announced. It is said that $400,000 was paid for the properties. The combined systems have 19 miles of track and thirty-two cars. The Coffenberry-Bishop syndicate is also interested in the Dallas & Fort Worth Electric Railway, which is now constructing a line between Dallas and Fort Worth. With the city lines in Fort Worth and the interurban line between Dallas and Fort Worth, they will have a very complete system. R. S. Vivian, of Chicago, completed the negotiations for the transfer.

Land Owners' Road Rights

Judge Landis, of Lancaster, Pa., has just rendered a decision in which he holds that electric railway companies cannot force themselves into neighborhoods where they are not wanted, and that the owners of land control a thoroughfare to its middle. In rendering his decision the judge holds that, the principle having been settled that the right of the soil of a highway resides in the properties of the land over which it has been laid, the plaintiff controls one side of the road, on which the company may not build, but they may build on the other half, if the owner of abutting property does not object, and no damage is done the plaintiff's property.

The G. A. R. Reunion and Chicago Traffic

The G. A. R. reunion held in Chicago last week was responsible for an increase in the street railway traffic such as has not been experienced by the roads for some time. No official figures of the number of passengers transported are obtainable, but the cars were taxed to their utmost capacity at all times. The companies had early realized that there would be some difficulty in handling the crowds, and had every available car in commission. However, it is not expected that the companies could meet the sudden demand made by such a big event, and considering all things there was no cause for complaint. The crowds were handled as expeditiously as could be expected under the existing circumstances.

Justifiable Profanity

Judge Mills, of Washington, D. C., has created somewhat of a sensation by discharging a prisoner arraigned before him on the charge of using blasphemous language, saying that the defendant was justified in using profane language, and that the act was praiseworthy. Swearing is against the law in Washington, and those arrested on a charge of this kind are usually convicted and punished. The prisoner, when arraigned, said that the recent changes in the transfer system of the lines of the Washington Traction & Electric Company had led him to swear, and freely admitted that he had used rather harsh language. The judge said that the changes in the system had resulted in many complications, and, after a lengthy rehearsal of the facts by the prisoner, finally discharged him, saying that the act was justifiable in his case.

Railway Suggestions Invited by Mail

After careful consideration the Chicago Street Railway Commission has decided to invite suggestions by mail from the residents of the city on the traction situation. A number of questions are now being prepared by the commission, on which it especially desires the public at large to express its opinion. The object is to obtain the popular side of this absorbing topic, and this was considered the most expeditious way to obtain it. Among the questions to be asked are the following:

Do you want the city to own and operate the street railways, or would it be more satisfactory for the municipality to hold title in

the rails and lease their use to the different companies which may desire to furnish accommodation to the people?

How would a subway system equipped with all the conveniences known to modern engineering suit you?

In the event of the city authorities extending the franchises of the companies what term would you fix as the limit?

Chicago Companies Deny Right of the City to Compel the Lowering of Tunnels

The Chicago Union Traction Company, West Chicago Street Railway Company and the North Chicago Street Railway Company have filed a general denial in the Circuit Court of the right of the city to compel the lowering of the street railway tunnels beneath the river. Petitions asking the enforced lowering of the three tunnels, at Van Buren, Washington and La Salle Streets, sought the issuance of the order on the ground that the use of the river as a natural highway was being obstructed by the tunnels. Changes in the draft of vessels in the lake carrying trade making a water depth of at least 21 ft. necessary were advanced in support of the proposition to compel the lowering of the tunnels. The jurisdiction of the city to clear the river of all obstructions was declared to be absolute, and the ordinance of March, 1900, was quoted commanding the lowering of the tunnels. The answers of the three companies deny that the tunnels are an obstruction; that the city has no jurisdiction, and that the ordinance is void and in violation of the clause of the Federal Constitution, which declares that no State shall pass any law impairing the obligation of contracts.

Accident Fakir Cleverly Trapped

A systematic attempt to swindle street railway companies throughout the country was made public Sept. 1, when Frank Lieblang, of Cleveland, was arrested in Harper Hospital, Detroit, on the charge of obtaining money under false pretenses. Joseph A. Hosman, a detective in the employ of the Cleveland Electric Railway Company, was engaged to shadow Lieblang and set a trap to catch him. Lieblang's plan was to fall from a moving car and claim to receive serious injuries, his claims being substantiated by a physician who was in the plot. Lieblang owns a saloon in Cleveland, and Hosman gained his confidence by hiring out as a bartender. Later Hosman entered into a plot to swindle a Detroit railway. Last Tuesday he fell from a car in Detroit, and although he states that he received no other injuries than a sprained wrist, he managed through tricks shown him by Lieblang to deceive the surgeons into believing he was badly injured. He was taken to a hospital, and Lieblang conducted negotiations with the street car company, and obtained $200 as a settlement. He was arrested when he went to the hospital to divide the money with Hosman. Hosman says they tried the accident game in New York, but failed. Lieblang has a suit for $10,000 damages pending against the Cleveland company. Last winter he is said to have secured a verdict against the city of Cleveland for $5,555 for injuries suffered by falling into a hole. The Cleveland company has sent H. J. Latimer to Detroit to assist in the prosecution of Lieblang.

International Tramway Congress

The programme of the International Tramway Congress, to be held at Paris Sept. 9-13, has been made public by the executive committee. The list of papers to be presented at the congress was published in the Street Railway Journal for March, page 258. The social programme is as follows:

On Sunday, Sept. 9, at 9 o'clock in the evening, there will be a social meeting of the delegates at the Continental Hotel. The first regular session of the congress will be held on Sept. 10, at 10 a. m., at which the papers by Messrs Géron and Pirch will be presented. At 2 o'clock in the afternoon a visit will be made to the Metropolitan underground road, and a trip will be taken to the Vincennes Exposition. Return will be made by electric tramway cars. The second regular session of the congress will be held on Sept. 11 at 9 a. m., at which the papers of Messrs. Gunderloch, Thonet, d'Hoop, Van Vloten and Fischer-Dick will be presented. At 3 o'clock in the afternoon a reception will be extended to the delegates at the City Hall by the municipal authorities, after which a trip will be made to the electrical subway of the Orleans Railroad Company. The session on Thursday, Sept. 12, will be called to order at 9 o'clock in the morning, and papers will be presented by Messrs. Broca, Johannet, de Burlet and Ziffer. The afternoon will be devoted to a visit to the compressed-air station of the General Omnibus Company, and the electric-power station of the West Parisian road at Moulineaux. On the morning of Friday, Sept. 13, the final papers and schedules for the congress will be presented by Messrs. Macloskie and Monmerqué. In the afternoon a visit will be made to Saint Germain, and in the evening a banquet will be held at the Palais d'Orsay.

The officers and official delegates to the congress are as follows:

HONORARY PRESIDENT

Baudin, Pierre, Minister of Public Works.

GENERAL COMMITTEE

President

Janssen, Léon, general manager of the Société anonyme les Tramways Bruxellois, Brussels.

Members

Messrs. Aigoin, president of the Compagnie generale parisienne de Tramways, Paris.

Broca, manager of the Compagnie des Tramways de Paris et du Department de la Seine, Paris.

Cuvinot, Senator and president of the Compagnie generale des Omnibus, Paris.

Fuster, secretary of the Union des Tramways de France, Paris.

Géron, manager of the Société des Tramways de Cologne, Cologne.

Guary, manager of the Compagnie generale francaise de Tramways, Paris.

Kessels, manager of the Société generale de chemins de fer economiques, Brussels.

Köhler, manager of the Grosse Berliner Strassenbahn Gesellschaft, Berlin.

Lavalard, associate manager of the Compagnie generale des Omnibus, Paris.

Monmerque, chief engineer of Bridge and Highways, chief engineer of the Compagnie generale des Omnibus, Paris.

Radice, president Italian Tramway Association, Milan.

Röhl, manager of the Société des Tramways of Hamburg.

Ziffer, president of several railway companies in Austria, Vienna.

General Secretary

Nonnenberg, F., manager of several street railway companies, Brussels.

Secretary

Janssen, Albert, manager of the Société des Tramways Bruxellois, Brussels.

DELEGATES APPOINTED BY DIFFERENT GOVERNMENTS

Austria

Edler von Leber, Max, ministerial councillor, Vienna.

Strzizek, Franz, chief engineer, Vienna.

Freund, Ludwig, imperial councillor and chief engineer of the State railways of Austria.

Belgium

Janssen, L., general manager of the Tramways Bruxellois, Brussels.

Nonnenberg, F., manager of several tramway companies, Brussels.

Janssen, A., manager of the Tramways Bruxellois, Brussels.

Nyst, F., engineer at Liége.

Canada

Mavor, James, professor of political economy at the University of Toronto, and commissioner general of Canada at Paris.

France

Plazen, appointee of the Minister of Agriculture, Paris.

Holland

Van Leuwen, J., engineer of the State Railways, the Hague.

Hungary

Kadar, G., technical councillor, Buda-Pest.

Monaco

Bergés, P. A., manager of public works, Monaco.

Roumania

Remush, A., forestry engineer, Paris.

Russia

Redel, Commissioner General of Russia at Paris.

Siam

Hoeylaert, H., Consul General of Siam at Brussels.

Rolin, E., Consul General of Siam at Brussels.

Sweden

Fränckle, Member of the Industrial Chamber, Stockholm.

Spain

Pedro Garcia Faria, Commissioner General of Spain at Paris.

United States

Colonel Truesdell, G., president of the Capital Traction Company, Washington.

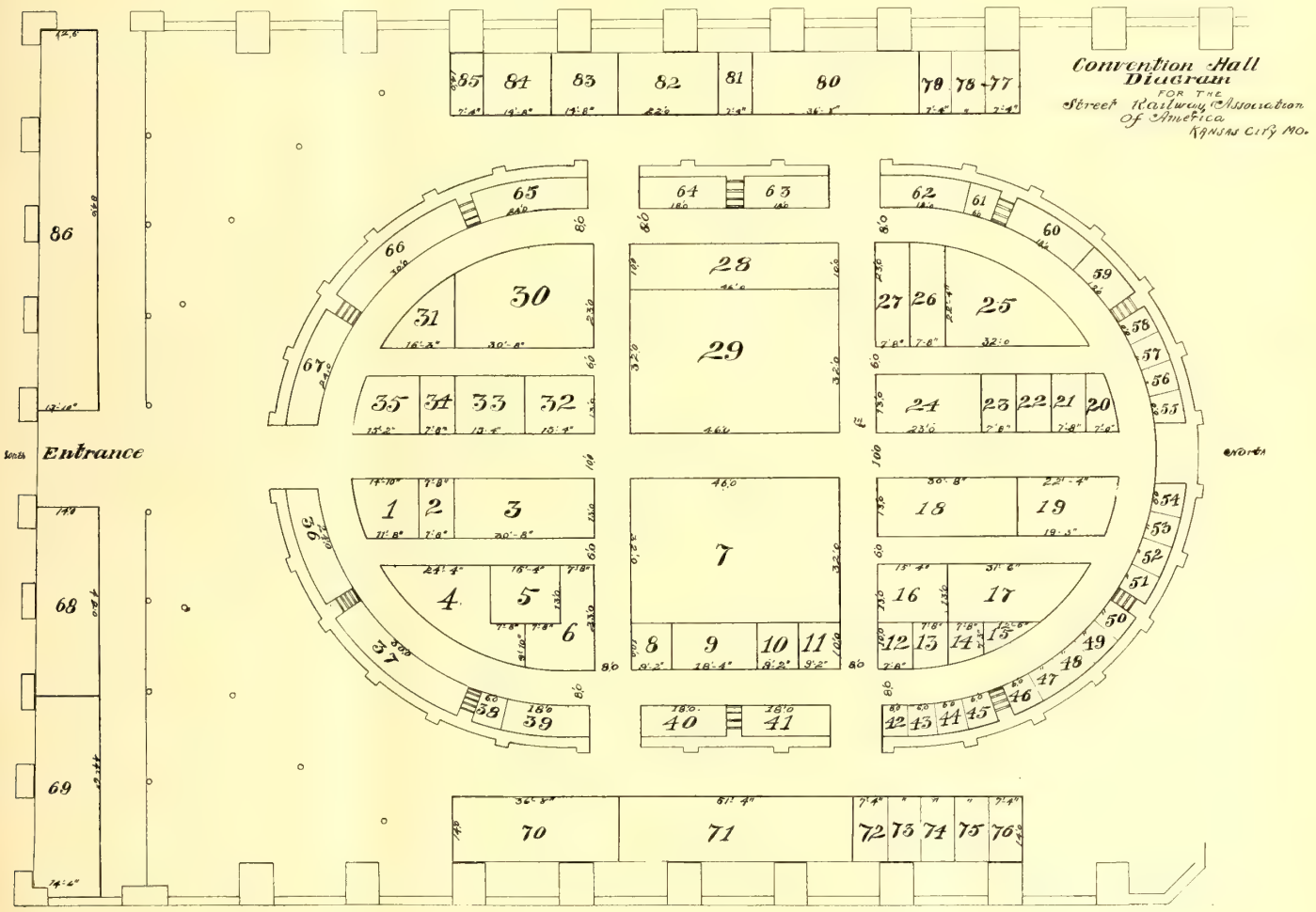
Professor Wilkins, F. S., professor of civil engineering, University of Alabama and assistant in department of transportation.

Allen, W., secretary Massachusetts State Commission.

Assignment of Exhibit Space for American Street Railway Association Convention

A plan showing the exhibit space in Convention Hall, at Kansas City, together with the names of exhibitors and the number of square feet engaged by each, is presented herewith. This is up to date, and leaves only a few spaces not yet taken:

No. of Space	Name of Exhibitor	No. Sq. Ft.
16	Atlas Railway Supply Company	200
22	American Railway Supply Company	100
33	Garton-Daniels Company	200
19	Gold Street Car Heating Company	300
29	General Electric Company	1,500
9	Garl Electric Company	200
25 and 26	Hipwood-Barrett Manufacturing Company	620
66	International Register Company	200
3	K. C. Car & Foundry Company	400
86	Lorain Steel Company	1,000
20	Leschen, A., Sons Rope Company	100
24	McGill, Porter & Berg	300
27	Manville Covering Company	200
36	McRoy, John T.	160
83	Merritt Electric Air Brake Company	200
85	Magann, G. P., Air Brake Company	100
23	National Lead Company	100
65	New Haven Car Register Company	160
42 to 45	Nuttall, R. D., Company	160
4	Ohio Brass Works	400
60	Ohmer Car Register Company	120
67	Pittsburgh Reduction Company	160
68	Peckham Truck Company	500



5	Adams & Westlake Company	200
28	American Car & Foundry Company	500
13	American Brake Shoe Company	100
18	Brown, Harold P.	400
63	B. R. Electric Company	120
10	Bierbaum & Merrick Metal Company	100
6	Curtain Supply Company	300
17	Chisholm & Moore Manufacturing Company	400
30	Christensen Engineering Company	800
62	Chicago Mica Company	120
32	Consolidated Car Heating Company	200
15	Continuous Rail-Joint Company	50
31	Cutler Hammer Manufacturing Company	150
80	Compressed Air Company	500
84	Creaghead Engineering Company	200
37	Dixon, Joseph, Crucible Company	200
12	Diamond State Steel Company	100
51, 52 and 53	Dearborn Drug & Chemical Company	120
34	Electrical Review Publishing Company	100
59	Pomeroy & Fisher	80
8	Pantasote Company	100
55 to 57	Partridge Carbon Works	120
40	Ridlon, Frank, Company	120
1	Street Railway Review	200
35	Street Railway Journal	200
64	Scott, Charles, Spring Company	120
21	Standard Paint Company	100
11	Standard Underground Cable Company	100
54	Spiral Journal Bearing Company	40
69	Taylor Electric Truck Company	500
39	Trojan Button Fastener Company	120
82	Wharton, William, Jr., & Company	300
41	Wood, Charles N.	120
7	Westinghouse Electric & Manufacturing Company	1,500
71	Westinghouse Air Brake Company	700
14	Weber Railway Joint Manufacturing Company	100
2	Western Electrician	100
81	Wheel-Truing Brake Shoe Company	100

Notes From Germany

[*From Our Regular Correspondent.*]

A new telegraph law went into force this year permitting the postal department to utilize public roads for the stringing of telegraph and telephone wires. The effects of these new rights are now being slowly felt. Because the departments could in the past demand payment from individuals or companies who interfered with their lines or caused disturbances therein, Parliament was reluctant to pass the new law. The municipalities claimed that in case they wanted to build roads themselves, they would not even be masters of their own highways. Parliament finally decided that the postal department could demand payment for damages done by private parties, but not by the owners of the highways, *i. e.*, the municipalities. Should the road be purchased by a private party, then the latter must pay for any expense incurred by the department in protecting its lines. This law is of great importance to municipalities, as they can now build roads more cheaply. Formerly the expense of removing telegraph and telephone lines was frequently greater than the building of the road itself, as, for example, in the case now existing at Wiesbaden.

The fact that the State government has, within recent times, frequently granted an extension of franchises to private companies without referring the matter to the municipalities which own the highways, has induced the various city governments to adopt resolutions plainly showing to the State authorities that in the future they will build electric roads themselves. It is, however, not the intention of the cities to operate small, unprofitable roads in connection with an established city railway system, but they want to embody the condition that every party to whom a franchise is granted must have operated a road before. At the same time the cities are gaining valuable experience in the running of roads and the training of employees, but to anybody trained in electric railway practice it is clear that they do not fully realize what is required of a capable superintendent. The cities of Berlin, Charlottenburg and Breslau have adopted such resolutions.

On several much frequented streets of Berlin, such as on Leipziger Strasse, the police department had forbidden the use of trailers, on the ground that the length of motor car and trailer greatly interferes with the traffic. This action was firmly supported by the cab proprietors, who were jealous of the cheap transportation furnished to people by the trailer system, and based their complaints on the doubtful assertion that the trailers were very dangerous. Recent statistics in regard to accidents, however, prove that more accidents are due to motor cars than to trailers, and this has induced the police department to reverse its decision and permit trailers on all streets. This is of importance, as all the large lines connecting the east with the west of Berlin must pass through Leipziger Strasse, and a direct and uninterrupted traffic is thus afforded. In Germany the cost of running a trailer is about one-half of that required to operate a motor car.

As in America, it is found in Germany, that the suburban electric car lines seriously affect the traffic of the heavy steam roads. This is evidenced by frequent notices posted by the railway companies, of which the following is an example: "On account of the recent opening of the electric road, it has been observed that the traffic has been considerably reduced on our suburban trains. On the first two trains there are, on an average, fourteen passengers, and on the last two trains thirteen, so that we feel justified in discontinuing these trains on week days."

The recent trial trips on the Wannsee electric road have induced the military authorities to continue the experiments on the military road, which connects Berlin and Mariendorf with the artillery proving grounds at Zossen. The trials are being conducted by a Berlin company devoted to high-speed electric roads, called the Studien Gesellschaft. Siemens & Halske and the Allgemeine Elektricitäts Gesellschaft will each furnish a motor car which has to meet the following requirements: The cars are 26 ft. long, seat sixty people, and weigh 70 tons. Three-phase current is furnished by the central station at Oberspree at a pressure of 12,000 volts. In the cars themselves this is reduced by means of transformers to 1000 volts. It is desired principally to show by these trials that the desired speed of 200 km per hour can be attained.

The electric omnibus line which began operations in Berlin a few weeks ago may be considered a formidable competitor of the electric street car lines. On the opening day a number of invited guests were met at 7 o'clock at the charging station in front of the Stettiner depot, by Director Meyer, of the company, who welcomed them and invited them to enter a gaily decorated bus. Several streets were traversed and the line then declared open. The eight buses followed at a headway of nine minutes. In equipment the buses resemble those of the already existing line. The fare over the entire line is 10 pfennigs; but certain distances may be traveled over for 5 pfennigs.

The Grosse Berliner Strassenbahn, which had already consolidated with it the South and West Berlin suburban lines, as well as the new Berlin horse-car line, has recently purchased the majority of the shares of the accumulator road from Berlin to Charlottenburg. This was accomplished so secretly that nothing was known of it until the deal was completed. The scarcity of money recently induced a banking house owning most of the shares to sell the same to the Grosse Berliner Strassenbahn. The Berlin-Charlottenburg road paid last year a 3 per cent dividend and a 5½ per cent dividend in the previous year. The transfer price is 142 per cent, so that the stock is being well paid for. It should be remarked in addition that the purchased company's franchise was also extended until 1950, which, for German conditions, is a very long time. The capital stock of the Berlin-Charlottenburg road is M.9,000,000. It possesses one hundred cars, while the Grosse Berliner road has 2000.

As all the cases which arose out of the recent Berlin strike are about settled, it is found that 150 years in prison is the total punishment for the offenders. Aside from these, however, there is still a civil case to be settled, which is of more than usual interest. The advertising window panes in the cars belonging to a certain firm were destroyed by the mob. The firm now demands, in view of a certain law which holds the city responsible for property at the time of a public riot, that the city authorities pay for the damaged panes. The latter refused the demand, and pointed to an agreement between the city and the railway company which stated that the city cannot be held responsible for damage done to the company's property, if the same is caused by riots. The firm claims, however, that this private agreement does not have any bearing on the case, and the company claims that it is responsible for damage done to its own property but not to that of others. The decision is awaited with a great deal of interest.

The annual meeting of the "Verein Deutscher Strassenbahn und Kleinbahn Verwaltungen" will be held at Wiesbaden on Sept. 6, 7 and 8, 1900. The programme is as follows: Sept. 5, in the evening, general reception of the delegates. Sept. 6, at 9. a. m., general business, reading of papers and discussion; at 1 p. m., lunch; in the afternoon, sightseeing; in the evening, a dinner. Sept. 7, at 9 a. m., reading of papers and discussion; at 1 p. m., lunch; in the afternoon, short trips, and in the evening, the official dinner. Sept. 8, in the morning, a trip to Rüdesheim by special steamer; from there to Cologne. On Sept. 9, the trip is continued by the delegates to the international congress at Paris, which takes place from Sept. 10 to 13

The papers to be read at the meeting and the discussions are as follows: (1) Annual report. (2) Report on the accidents during 1899. (3) Brakes for electric street cars. (4) Construction of cars suitable for suburban and city tracks. (5) Report on the recommendations of the Elektrotechnische Verein in regard to safety appliances for electric street cars. (6) The wages movement of the employees. (7) Calculations in regard to cost of operation of two and four-axle motor cars and trailers. (8) The taxation of right-of-way agreements. (9) The adherence to the limits imposed by the small-roads law and the working of section 96. (10) Report on the transportation facilities at the Paris Exposition. (11) Report of the literary committee. (12) Discussion in regard to the possibility of the society gathering statistics in regard to German street railways, as suggested by the Imperial Minister of Public Works. (13) Report on the question in regard to the removal of snow and ice during the winter of 1899-1900. (14) Planning the society's work for 1900-1901. (15) Choice of the next meeting place.

The walls of the power station for the electric elevated and underground road of Berlin are finished. When completed the lower portion of the station will contain the machinery. This consists of three large steam engines of 900 hp each, having a speed of 115 r. p. m., and three direct-current generators, each having a capacity of 800 kw. On the upper stories are the boilers. Above these the coal pockets are located, which are supplied with coal by means of Hunt conveyors. The boilers and engines are now being installed. The chimney is completed, and has a height of 80 m (262 ft.).

A most emphatic protest against the free and frequently unnecessarily large use of oil at railway curves has been recently entered by the bicycle clubs and owners of automobiles, having pneumatic tires. The effect of the oil on the rubber of the tires is most injurious. It is quite probable that the ordinance demanding the use of expensive lubricants will soon be abolished, especially as it also proved to be a good insulation between wheel and rail, and greatly hampered the climbing of grades.

Experiments With Electric Traction on Trunk Railways*

BY N. H. HEFT
(Chief of electrical department, New York, New Haven and Hartford Railroad Company)

(Continued from page 788.)

Can trains be shifted at stations and yards as quickly?

Yes. When operated by third rail, motor cars can be run around train without turntable or other delay. When operated by overhead trolley a slight delay is caused by the necessary shifting of the trolley.

Can trains be run over frogs and through yards at same speed?

Yes, when operated with third-rail system. With overhead trolley system, provided the trolley is looked after and kept on the wire when passing through overhead frogs.

Can coaches be economically heated, and how would cost compare?

No. Experience has shown in the New England States, during the average winter weather, that a coach 60 ft. in length will require from 6 kw to 12 kw, and figured at the rate of 1 cent per kw-hour, costs from 6 cents to 12 cents per hour. With the temperature at zero the cost would be 18 cents per hour. From the best data received, the cost of heating the same coach with steam from locomotive in ordinary weather would be 2 cents per hour; zero weather, 3 cents per hour.

Can coaches be satisfactorily lighted, and how would cost compare with oil or gas?

Yes. The New York, New Haven & Hartford Railroad Company places thirty lamps of 16 cp in a 60-ft. coach. These lamps would consume 1500 watt-hours or 1½ kw-hours. At 1 cent per kw-hour the cost would be 1½ cents per hour, and, taking into consideration the cost of necessary attention, with oil or gas, would be fully as economical and more desirable.

Will the use of electric traction increase or decrease wear on tracks per train-mile run.

With electric locomotives or motor cars of equal weight, the wear on service rails would be less, due partially to the rotary application of the power and partially to the fact that with electric motors no dead weight need be carried outside of weight on driving wheels necessary for traction.

How will passenger receipts be affected by more frequent service of lighter trains?

The receipts will be increased, as shown by a comparison of the number of passengers carried by the New York, New Haven & Hartford Railroad Company on the Nantasket Beach, Highland, Berlin and New Canaan branches, with steam trains, and electric trains with more frequent service.

	Steam	Electric
Nantasket Beach	304,292	702,419
Highland division	387,695	1,060,617
Berlin branch	267,936	241,207
New Canaan branch	98,302	184,728

What kind of coach will be most satisfactory to the traveling public?

The local conditions govern as to the most desirable coach. For summer travel the open car is most desirable, provided speed does not exceed 20 miles per hour; for spring, fall and winter travel the closed coach with cross seats, center aisle, toilet room and water coolers.

On lines traversing the seashore the open coach is most desirable. The ideal coach is one that can be changed at will from an open to a closed coach. To meet the views of President Clark, who has long been a believer in the use of coaches of less weight for suburban and branch lines, and of such a design as would make the same available for both summer and winter service, the New York, New Haven & Hartford Company has designed such a coach for service on its Providence, Warren & Bristol branch, now being equipped for electric traction.

Maximum speed at which to run open cars?

Not to exceed a train schedule of 14 miles to 15 miles, including stops, with a maximum speed of 20 miles per hour between stations.

Will electric traction on main lines between towns and cities, with frequent service, higher speed, and equal fare, be more attractive than the street railways which parallel the steam lines, cover the same terminals, take up and leave passengers at their own doors, but consume more time?

Yes. Experience on two main steam railroads shows that after the substitution of electric traction they have not only regained the lost travel, but have made monthly gains during the last two years, showing that the passenger will travel by the shortest route, even when other conditions are not equal.

What is the maximum distance that power can be transmitted economically by direct current?

Ten miles to 15 miles under ordinary conditions on main lines.

What is the maximum voltage allowable in the working conductor when using direct current?

Experience with third-rail systems has demonstrated that 700 volts can be maintained on the working conductor without giving trouble. With voltage exceeding 700, arcs and short circuits are hard to prevent. Owing to difficulties of motor insulation and commutation with voltages much higher than 700, the same limit may be taken for all forms of working conductors.

Can freight trains be operated?

Yes. The Baltimore & Ohio Railroad Company operates all passenger and freight trains passing east and west through the city of Baltimore over its main trunk line, and the writer is advised that the service operated is satisfactory from every standpoint.

The Erie Railroad Company leased its branch line between Buffalo and Lockport to the Buffalo & Niagara Falls Electric Railway, which has been operating a freight service with special electric locomotives. The management reports that this service is operated, in connection with passenger, mail and express, most satisfactorily.

There are several other railways operating a freight service with equal success.

For weights of trains operated by the Baltimore & Ohio Railway Company, see their answers, Appendix. Trains of fifteen to twenty cars, each loaded with 30,000 lbs. of freight, are operated on the Buffalo & Lockport line.

What should be the location and equipment of motor car house?

The motor car houses should be located at the most central point, preferably close to the power station; this will allow the use of either steam or electricity for power required in the maintenance of motors and cars. The design should provide for the repair shop being placed under house tracks, provided with power hoists, so arranged that motor cars can be run over them. Power jacks should be provided to lift coach body from trucks, to permit cables and brakes to be quickly disconnected and allow the dropping of the trucks into the repair room below. The motors and trucks being interchangeable, this arrangement allows the replacing of motors or trucks with a minimum loss of time. The repair shop should be provided with tools for making repairs only, it having been found to be in the line of economy to purchase repair parts from the manufacturers.

Are motors satisfactory?

Experience in the use of heavy railway motors is limited to the past five years, and there are but few distinct types. The first motors followed the light railway practice by the adoption of four poles instead of two. These motors were so wound as to produce two salient and two consequent poles. The motor frame completely enclosed the armature, and no provision was made for ventilation. The bearings were insufficient in size, the journal brasses or linings were badly designed, and the methods of lubrication were crude. The air gap, or distance between the armature and the pole faces, was so small that a slight wear on the armature-bearing brasses was sufficient to allow the former to drop down and come in contact with the lower pole face, which immediately disabled the motor by burning out the armature. The experience of the railway managements, operating these motors, quickly developed the above defects, and their demands upon the manufacturers resulted in the design of a motor with increased power, with four salient poles, a much larger air gap, greatly improved journal boxes, and a method of lubrication which is satisfactory. In the method of ventilation, and the general design of the gear cases, there is room for radical improvement. These motors are geared to the axles by a single pair of gears, but in the heaviest type of electric locomotives the armatures are mounted directly upon the axle.

The experienced gained in the operation of heavy electric railway motors shows that the work that they are called upon to perform is even more severe than that required of steam locomotives. They are required to attain an equal if not greater schedule speed. The number of miles run per day is from 200 to 400, which is much more than is required of any steam locomotive in regular service. With such conditions existing, it is evident that the strictest care must be exercised in the design of the mechanical details of motors and in their maintenance.

Are motor trucks satisfactory?

In the design of a motor truck, special attention should be paid to strength of frame, size and composition of wheels, dimensions of axles, springs, brakes and the motor suspension. A motor truck carrying two heavy motors in some cases weighs 25,000 lbs.

* Abstract of paper to be presented at the International Railway Congress, Paris, Sept. 20-29.

The wheels should be standard, with steel tires. It should not be forgotten that, as these trucks are to do the work of a steam locomotive, the axles should be of proportional strength. Experience on the New York, New Haven & Hartford Railroad with light axles, considered to be of ample dimensions for the required service, demonstrated to the management that the motor axles must be increased in size. The standard axle adopted by this company for motor trucks is 8 ins. in diameter at gear wheel hub, and 6½ ins. at motor bearing and wheel fit with journals 5½ ins. x 9 ins. These axles are oil tempered and have 1½-in. hole through the center.

The brakes should be arranged without a brake beam, for convenience in inspecting motors.

The form of motor suspension is of great importance. The ordinary method used on heavy roads is to hang the rear end of the motors in journals on the axles, while the front end is supported by springs attached to the bolster of the truck. This method has serious disadvantages. The truck springs, having to support half the weight of the motors, as well as the coach body, are necessarily made larger and heavier than usual. The uneven strain on these springs, in addition to their being unnecessarily heavy for the coach body, produces a rigidity, causing the coach to ride with discomfort when partially loaded. The motor suspension now used by the New York, New Haven & Hartford Railroad Company differs from the above in that the motors are supported entirely by the axles, no part of their weight being carried by the truck frame or the springs supporting the coach body. This is accomplished by the use of two equalizing suspension bars, which extend from one axle to the other beneath, and on each side of, the motors. These bars are supported at their ends by links, which are held by lugs cast on the motor frames, directly under the motor axle bearings.

With the present railways motors, it has been demonstrated that either heavy or light trains can be operated over the same tracks, and can perform any service required of the steam locomotive. These motors can be mounted on trucks, as with either one or two motors on each truck. The coach then becomes the locomotive. Its whole weight is available for traction, and, in addition, it has a seating capacity equal to any coach operated with the steam locomotive. A coach such as is used on the Highland division of the New York, New Haven & Hartford Railroad, having a seating capacity of seventy passengers, equipped with two motors on one truck placed under one end, and using a standard passenger truck on the other end, can be used as a single car during the hours when travel is light, with trail coaches added, as required, during the hours of heavy travel. Two coaches in addition to motor car used on this line, make a train weighing 161,000 lbs., and operating a train schedule of 30 miles per hour, including stops. The seating capacity of such a train is 174 passengers. With two motors on each truck placed under such a coach, we have a locomotive with 100,000 lbs. on drivers, and a total weight, including pasengers, of 110,500 lbs. available for traction, when carrying seventy passengers.

A comparison with a standard steam locomotive designed for suburban service is of interest. It shows the total weight to be 166,000 lbs., with 72,000 lbs. on drivers, leaving 94,000 lbs. as dead weight, and not providing any passenger seating capacity.

The results obtained with electric traction on main line railroads demonstrate that the present application of this power is no longer experimental; that it will rapidly supersede steam on lines where travel is heavy and congested, and where, for economy in operation and increased passenger receipts, a frequent service is necessary.

This mysterious and silent power will undoubtedly continue to grow in popularity, taking an advanced position among the known motive powers of the world.

APPENDIX

In the series of answers given below:

A stands for Plymouth division of N. Y., N. H. & H. R. R., Nantasket Junction to Pemberton; Braintree to Cohasset.

B stands for Highland and Hartford divisions of N. Y., N. H. & H. R. R., Berlin to New Britain.

C stands for New York division, Stamford to New Canaan, of same road.

D stands for Pennsylvania Railroad Company, Bordentown and Mount Holly branch.

E stands for Baltimore & Ohio Railroad Company, Baltimore Belt Line.

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1. Do you use electric traction? As an experiment? Or in regular service?

A. Yes. No. Yes. *B.* Yes. In regular service. *C.* Yes. No. Yes. *D.* Yes. In regular service. *E.* Regular service.

2. Describe in a general way the system or systems you have adopted?

A. Nantasket Junction to Pemberton, overhead trolley; center bracket construction; double track. Braintree to Cohasset, third-rail construction, overhead trolley at stations. *B.* Third rail, direct-current system. *C.* Overhead trolley construction, flexible brackets on octagonal wood poles (30-ft. x 10-in. butt x 8-in. top), supporting 000 and 0000 round wire. *D.* Westinghouse. *E.* Overhead trolley—using an iron conductor made up of two Z bars 3 ins. x 3 ins. x ⅜ in. covered with 12-in. x ¼-in. plate.

3. On what lines are they in use and how long have they been in operation?

A. Plymouth division, summer months. Nantasket Junction to Pemberton, five years; Nantasket Junction to East Weymouth, four years; Nantasket Junction to Braintree, via East Weymouth, two years; extension from Nantasket Junction to Cohasset, one year. During Summer months only. *B.* Highland division, Hartford to Bristol, Hartford division, Berlin to New Britain, two years three months. *C.* New Canaan branch on New York division. Has been in operation since 1898. *D.* Burlington branch, Camden and Burlington County Railroad, Amboy division, Pennsylvania Railroad Company. Since July, 1895. *E.* Used on the Philadelphia division of Baltimore & Ohio Railroad. Have been in operation nearly four years.

LINE OR TRACK

4. Give the length of the different lines operated by electricity?

A. Nantasket Junction to Pemberton, 7.0 miles; Braintree to Cohasset, 10.5. Pemberton service continued from Nantasket Junction to Braintree over same tracks. *B.* Hartford to Bristol, 18 miles; Berlin to New Britain, 3 miles. *C.* 7.66 miles. *D.* 7.1 miles. *E.* Belt line, 4 miles in length.

5. The type of rails used and their weight per yard?

A. Nantasket Junction to Pemberton, 76-lb. T; Braintree to Cohasset, 100 lbs., 6 ins. *B.* Steel T-rail, 74 lbs. per yard. *C.* 4¾-in. T-rail, 72 and 74 lbs. per yard. *D.* T-rail 56 to 70 lbs. *E.* A. S. C. E. standard, 85 lbs. to the yard.

6. Single or double track?

A. Double throughout. *B.* 18 miles single, 3 miles double. *C.* Single with turnouts. *D.* Single track. *E.* Double.

7. Give the maximum grade and curvature?

A. Maximum grade on Pemberton section, 1.07 per cent; on Braintree section, 0.687 per cent. maximum curvature at Braintree, 15 degrees; maximum curvature on Pemberton section, 10 degrees. *B.* 65 ft. per mile; 10 degrees. *C.* Maximum grade, 52.8 ft. per mile, 1 per cent; maximum curvature, 7 degrees. *D.* Maximum grade, 80 ft. to mile; 310-ft. radius at Mt. Holly. *E.* Maximum grade, 1.5 per cent; curvature, 10 degrees.

8. Gage of track?

A. 4 ft. 8½ins. *B.* 4 ft. 8½ ins. *C.* 4 ft. 8½ ins. *D.* 4 ft. 8½ ins. *E.* 4 ft. 8½ ins.

9. Character of ballast used?

A. Gravel and sand. *B.* Gravel. *C.* Gravel. *D.* Cinder and gravel. *E.* Stone.

10. Wood or metal ties?

A. Wood. *B.* Wood. *C.* Wood. *D.* Wood. *E.* Wood.

11. Describe the type of rail-joint?

A. Standard angle bar fastened with four ¾-in. bolts. *B.* Four-bolt and six-bolt angle spliced bar, suspended joints. *C.* Standard angle bars fastened by four ¾-in. bolts. *D.* Angle splice bar. *E.* Continuous.

12. Give number of highway crossings at grade?

A. Pemberton section, 9; Braintree section, 27. *D.* Twelve. *E.* None.

POWER STATIONS

13. Give the number of power stations for each line?

A. One. *B.* One for all. *C.* One. *D.* One. *E.* One.

14. The position of the power stations relative to the line?

A. One mile from Nantasket Junction on line toward Pemberton. *B.* At the outer end of the 3-mile line joining the center of the 18-mile line. *C.* At Stamford end. *D.* East end of line. *E.* At one end.

15. Their rated capacity in kilowatts?

A. 1100 kw. *B.* 1700 kw. *C.* 600 kw. *D.* 200 kw equal to 266 hp to switchboard at 100-lb. steam pressure. *E.* Between 800,000 and 900,000 kw-hours per month.

16. The number of power units in each station and the output of each unit?

A. Two. 550-kw generators. *B.* Two. 850-kw each. *C.* Two. 300-kw generators. *D.* One. Output as above. *E.* 5 units, 500 kw each.

17. The number and type of boilers in each station and the horse-power rating of each?

A. Eight horizontal return fire tube cylindrical of 125 hp each. *B.* Ten steel return tubular boilers, 125 hp nominal each. *C.* Six horizontal return fire tube. 125 hp. *D.* One. Climax. 300 hp.

18. The number of boilers in use during ordinary traffic?

A. Four to six. *B.* Four. *C.* Two. During winter months a third boiler is used for heating New York division coaches. *D.* One. *E.* Eleven.

19. What is the fuel used?

A. Sparks collected from extension fronts of locomotives. *B.* Locomotive sparks. *C.* Sparks collected from smoke fronts of locomotives in round houses. *D.* Bituminous coal. *E.* Cumberland coal run of mine. Bituminous.

20. Give the weight of fuel consumed per kw-hour produced at the switchboard?

A. 6 lbs. when clean. *B.* 7 to 8 lbs. per kw-hour when clean. *D.* Thermal units: Quarter load, 2.7; half load, 3.75; full load, 4.8. *E.* 4.53 lbs.

21. Number of pounds of water evaporated per pound of fuel?

A. About 4½. Equivalent for coal, 9 lbs. *B.* About 4.9. Equivalent for coal, 9.8 lbs. *C.* 4.9. Equivalent for coal, 9.8 lbs. *D.* 6.14 to 9.42 lbs. *E.* Average between 9 and 10 lbs.

22. Do you use forced draft?

A. "Argand" steam blowers in ash-pit fronts to ignite sparks, and for use under abnormal loads. *B.* Yes. *C.* Yes; to ignite sparks, and during excessive loads. *D.* No. *E.* Induced.

23. What steam pressure is used?

A. 120 lbs. per sq. in. *B.* 120 lbs. *C.* 100 lbs. to 120 lbs. *D.* 130 lbs. *E.* 125 lbs.

24. Give dimensions of smoke-stack?

A. Height above grates, 112 ft.; diameter of bore, 6 ft. 6 ins. *B.* 7½-ft. flue. 123 ft. high, above grates. *C.* Height above grates 113 ft.; diameter of bore, 6 ft. 6 ins. *D.* 40 ins. diameter; height 70 ft. above grate. *E.* 8 ft. diameter projecting only above roof.

25. What is the general plan of piping used to secure dry steam? Percentage of moisture in steam?

A. Copper bends rise from boilers into 16-in wrought iron header in boiler room. Engine connections made of wrought iron bends tapped into risers from header. Percentage moisture in steam is 1 per cent and less. *B.* Boilers below engines. Pipes rise from boilers to main header and fall to engines. *C.* Copper bends rise from boilers into 16-in. wrought iron header in boiler room. Engine connections made of wrought iron bends tapped into steam header. Percentage moisture in steam, 1 per cent and less. *D.* Straight line from boiler to engine, with steam trap attached leg of same. 3.4 per cent to 4.7 per cent. *E.* Separators, Lox and Holly drips.

26. Is the condensation in piping returned to the boilers?

A. Yes. *B.* Yes. *C.* Yes. *D.* No. *E.* Yes.

27. If so, how?

A. By Holly gravity return system. *B.* Holly gravity return system. *C.* By Holly gravity return system. *E.* Holly and Lox drips.

28. How is the feed-water heated?

A. By exhaust from engines in two horizontal Berryman heaters, and by condenser and feed pump exhausts in one auxiliary vertical Berryman heater in boiler room. *B.* By exhaust from engines through primary and auxiliary heaters of Berryman type. *C.* By exhaust steam from engines passing through Berryman horizontal heater. *D.* Vertical type. Goubert feed-water heater. Exhaust steam from engine circulating around water tubes. *E.* Warren Webster feed-water heater.

29. What is the temperature of the feed-water upon entering the boilers?

A. 180 degs. to 212 degs. F. *B.* About 200 degs. F. *C.* 190 degs. to 212 degs. F. *D.* 194 degs. to 200 degs. F. *E.* About 210 degs. F.

30. Describe make and type of engines used in each station?

A. Engines tandem-compound condensing of "Greene Improved" type. *B.* 28 ins. and 48-in. x 48-in. Greene cross-compound engines. *C.* Greene improved; simple, non-condensing. *D.* Westinghouse, Kodak type, direct-connected. *E.* One Greene, four Allis-Corliss. All tandem compound.

31. Give diameter of cylinders, length of stroke, revolutions per minute, length and diameter of shaft, and weight and diameter of fly-wheel?

A. Horse-power cylinder, diameter, 20 ins.; L. P. cylinder, diameter, 38 ins.; stroke, 48 ins.; revolutions per minute, 106; length of shaft, about 10 ft. between bearings; diameter of shaft at center, 18 ins.; weight of fly-wheel, 60,000 lbs.; diameter of fly-wheel, 18 ft. *B.* 28 ins. and 48 ins. diameter, 48-in. stroke, 100 r. p. m.; shaft 18 ins. x 2.16 ft.; fly-wheel, 55 tons; diameter, 18 ft. *C.* Diameter, cylinder, 26 ins.; length stroke, 48 ins.; revolutions per minute, 100; length shaft between journals, about 9 ft. 6 ins.; diameter of shaft, 16 ins.; weight of fly-wheel, 45,000 lbs.; diameter of fly-wheel, 18 ft. *D.* High, 18 ins.; low, 30 ins.; stroke, 16 ins.; revolutions per minute, 250; diameter of shaft, 8 ins.; weight of fly-wheel, 3000 x 6700 lbs.; diameter, 13½ ft. *E.* Allis, 24 ins. x 40 ins. x 42 ins.; 100 revolutions; length of shaft, 15 ft. 6 ins.; diameter of shaft, 16 ins.; weight of fly-wheel, about 18 tons; diameter of fly-wheel, 18 ft.

32. If condensing, describe the type of condensers used?

A. "Deane" jet condenser, jet condensing chamber mounted directly on water end of single steam circulating pump; no separate air pump. *B.* Deane independent horizontal condensers. *D.* Non-condensing. *E.* Don't condense.

33. Are the generators direct-connected or belted?

A. Direct-connected. *B.* Direct-connected. *C.* Direct-connected. *D.* Direct-connected. *E.* Direct.

34. How many of the stations generate direct current?

A. One. *C.* One. *D.* One.

35. What is the voltage at the station at full load? At no load?

A. Full load, 700 volts; no load, 650 volts. *B.* 700-650. *C.* 550 volts at full load, 500 volts at half load. *D.* 550 volts; 500 volts. *E.* 750 volts at all times.

36. Are so-called "boosters," or any apparatus for raising the voltage of a particular feeder or feeders used in the station?

A. No. *B.* No. *C.* No. *D.* No. *E.* Yes.

37. If so, how are they driven?

E. Motor-driven.

38. What apparatus is used to protect the generators from lightning discharges?

A. Shunt arresters of type G. E. M. D. placed in station, and arresters of type G. E. M. D. on pole line, one opposite station. *B.* G. E. Shunt lightning arresters. *C.* Arresters in station of type G. E. M. D. and four arresters on pole line of type G. E. M. D. *D.* Lightning arresters and tank arrester. *E.* General electric lightning arresters.

39. Has any damage from lightning occurred in those stations operating a third rail only, where no overhead conductors are used?

A. No. *B.* No.

40. Are storage batteries used?

A. No. *B.* Yes, for lighting only. *C.* For lighting only. *D.* No. *E.* No.

41. If so, describe the apparatus used to charge them?

B. Motor generator transforming direct current from 650 volts to 150 volts. Also directly through a rheostat in small plants. *C.* Motor generator of 25-kw capacity. Direct-connected. *D.* Not used.

42. Is any of the power of the station used for other purposes, such as supplying electric lights at the depots along the line or driving stationary motors for ventilation, heating or other power purposes?

A. One circuit of series arc lamps in power station, and incandescent lamps in car house, power station, and one station on line. *B.* Yes. To light passenger stations, freight houses, etc., and for lighting and heating cars. *C.* Yes. For lighting the Stamford passenger station and the freight houses; also during winter months one boiler is used for heating New York division coaches. *D.* Used for electric lights at power house and at Mt. Holly station. *E.* Yes.

CONDUCTORS

1.—The Positive Conductors

43. Give the position of the working conductor relative to the track?

A. Pemberton section, overhead. Braintree section, on blocks between rails of tracks. Overhead span construction at stations. *B.* In the center of the track on the ties. *C.* Overhead not divided into insulated sections *D.* Overhead. *E.* Overhead.

44. Of what metal does it consist?

A. Pemberton section, copper. Braintree section, steel. *B.* Steel, 100 lbs. per yard. *C.* Round, No. 000 and No. 0000, B. & S. copper wire. *D.* Copper. *E.* Iron with copper feeders.

45. If overhead, how is it supported and insulated?

A. Pemberton section, supported by mechanical clip hangers mounted on angle iron cross-arms bolted to poles between tracks. On steel trusses in yards where poles are outside of roadway. *C.* On brackets made up with flexible span. *D.* Cross suspension. *E.* Supported by catinaries attached to vertical columns. Cone insulators used.

46. If overhead, describe the poles used, their spacing, and the method of placing in the ground?

A. Poles of square Georgia pine, 30 ft. long, 12-in. x 14-in. butt, 10-in. x 12-in. top. Set 90 ft. apart on straight and 60 ft. to 90 ft. on curved line. Set in boxes 6 ft. deep, 3 ft. x 4 ft. across, filled with cement concrete. *C.* Poles of Georgia pine, machined octagonal, 10-in. butt, 8-in. top, 30 ft. long, set in ground; where ground is soft, set in barrels filled with stone, or grouted with cement concrete. *D.* Chestnut poles, 12-in. butt, 8-in. top, set 100 ft. apart and sufficiently high to give trolley wire a clearance of 22 ft. Poles as described in article 68. Concreted ground.

47. What means are used for protecting the line from lightning?

A. Lightning arresters on poles of type G. E. M. D. *C.* Four-pole lightning arresters. *D.* Lightning arresters. *E.* Lightning arresters at half-mile intervals.

48. If the working conductor is not overhead, give its position relative to the service rails?

A. On Braintree section, third rail of A section, 93 and 100 lbs. per yard is laid on creosoted wooden blocks between service rails. Blocks spiked to ties. Rails not fastened. *B.* Midway between the rails and projecting 1 in. above them.

49. Give the shape of its cross section and its area in square inches?

A. A shape, cross section of 9.3 and 10 sq. ins. *B.* Inverted V with flat top 10 sq. ins. area.

50. If of any other metal, give its conductivity as compared with copper?

A. Steel, 56 to 80 per cent carbon; conductivity, 1.8 to 1.9 that of copper. *B.* About 1.8 of that of copper of same area.

51. State how it is supported and insulated?

A. Laid without fastening on creosoted wooden blocks spiked to ties between service rails. *B.* Supported and insulated upon creosoted hardwood blocks fastened to the ties.

52. Describe the special arrangements used at grade crossings, switch-points, cross-overs, etc.

A. At grade crossings gaps in rail are bridged by bare copper cable (2,800,000 cm to each rail), laid in residuum compound-filled creosoted wood tubes laid in boxes filled with compound. Same done at switch-points. Overhead cable and trolley used at stations. *B.* The conductor rail ends at each side of a grade crossing, switch, and heavy copper conductors connect its ends, passing underground in an insulated wooden conduit.

53. Is it divided into sections automatically connected to the supply current by the motor car, or is it continuous throughout its length?

A. No. *B.* Continuous.

54. If sectional, what are the lengths of the sections?

55. Describe the automatic switches and the methods of operating them?

56. What is the method of bonding the conductor rail? Describe the bonds?

A. Bonds of tinned copper 4 ins. x 12 ins. x ⅛ in. inserted on each flange of A-shaped rail between underside of flange and splice plates. Splice plates, 4 ins. x 12 ins. x ⅝ in. Contact surface of bonds, 82 sq. ins. *B.* The bonds consist of two rectangular copper washers, tinned, 4 ins. wide by 12 ins. long, held by similar iron washers ⅜ in. thick underneath and 16 bolts. Contact surface, 82 sq. ins. *E.* Chicago bond.

57. Are these bonds equal in conductivity to the rail, or is there a loss in the joints?

A. Yes. No loss in joints. *B.* Yes, there is practically no loss. *E.* Equal.

58. State the leakage per mile in amperes in wet and dry weather?

A. About 4 amps. per mile in wet, and ½ amp. per mile in dry weather. *B.* One-half amp. per mile in dry weather; 4 amps. in wet. *C.* When new and in damp weather, 1-1000 amp. *E.* One-half amp. per mile.

59. If feeders are used, give their position and the metal of which they are made?

A. Third rail on Braintree section fed from the power station at Nantasket Junction (1 mile) by overhead bare copper cables of 800,000 and 500,000 cm area, supplemented by feeder made up of old rail, laid at side of roadway. *C.* None used. *C.* Bare copper feeders on glass insulators on cross-arms. Feeders of 300,000 cm and 500,000 cm area, and of 0000 bare soft-drawn copper wire. *E.* Copper laid on top of conductor.

60. If of steel and near the track, how are they supported and insulated?

A. 2.60 lb. steel rails bolted with flanges together and set on posts about 24 ins. high set every 10 ft. on side of roadway. Conductor boxed over with creosoted planks.

61. State where they tap the working conductor?

A. At Nantasket Junction, 1 mile from power station. *C.* About every 1000 ft one 500,000-cm feeder running 6 miles to feed grade.

62. What is the resistance per mile of the working conductor?

A. 0.044 ohms. *B.* 0.042 ohms.

2.—The Negative or Return Conductors.

63. Does the ground form an appreciable aid to the return circuit?

A. No. *B.* No. *C.* No. *D.* Yes. *E.* No.

64. Describe the bonds used and the method of bonding the service rails?

A. Bonds of leaf copper, made up with heads of drop-forged copper, expanded into holes in rail flange by taper pins driven into bond heads from above. Bonds inserted in holes in flange from below. Four bonds per joint. 24½ ins. long; 210½ ins. long. Total cross-section, 1,100,000 cir. mil. Also, older form of bond made up of No. 0000 copper cable (two per joint), with ⅝-in.

heads riveted into rail flanges from beneath. *B.* Bonds are four in number, of leaf copper, flexible and attached to the base of rails by lugs on bonds passing through holes in base. Lugs are then expanded in the hole by steel pins passing through a smaller hole in lugs. *C.* Rail joints bonded with two leaf copper bonds 4½ ins. long and two leaf copper bonds 10½ ins. long, made with 1-in. heads expanded into holes in base of rail by wedge-shaped or tapered steel plugs driven from above. Bonds underneath rail. Total cross section, 1,100,000 cir. mil. *D.* No. 0000 copper bonds. No. 00 copper cross bonds. *E.* Chicago bond, two No. 0000.

65. Are these bonds equal in carrying capacity to the rails they connect?

A. Yes. *B.* Yes. *C.* Yes. *D.* No.

66. What is the total cross section in square inches of return conductors?

A. Pemberton section, 30.4 sq. ins; Braintree section, 40.0 sq. ins. *B.* Single track about 14 sq. ins.; double, 28. *C.* 14.4 to 14.8 sq. ins. *D.* Outside of the rail, ¼ in. sq.

67. Are any special negative conductors used to supplement the service rails?

A. No. *B.* No. *C.* No. *D.* Yes.

68. If so, describe them?

D. One No. 0 return wire and cross-bond. *E.* 1-1,000,000 cir. mil copper.

69. What is the maximum drop in line voltage at the most distant point from the power station during maximum load?

A. Momentary drop of 350 volts at Braintree. *B.* About 50 per cent. *D.* 55 per cent.

70. What is the proportion of drop in the positive and negative during the above conditions?

A. Drop in negative about 50 per cent of drop in positive on Braintree section. *B.* Two-thirds in positive, one-third in negative.

71. What is the average efficiency of the line?

A. Average efficiency during maximum loads of Braintree section, 70 per cent. Average efficiency during the maximum loads of Pemberton section, 75 per cent. *B.* About 75 per cent. *D.* Good.

ROLLING STOCK

72. Are electric locomotives or passenger-carrying motor cars used? Are trailers used? If so, how many?

A. Passenger-carrying motors. Yes. One to four 12-ton open trailers and one to three 27-ton coaches, and one to three 30-ton coaches. *B.* Passenger-carrying motor cars and trailers. From one to four. *C.* Passenger and baggage carrying combination cars. Trailers are used. One and two. *D.* Passenger-carrying motor cars. Trailers are used. One or two. *E.* Locomotives, three.

73. How many motor cars or locomotives are in use? Give their weight empty, and the number of passengers they seat?

A. Regular service between Braintree and Pemberton, six open 33-ton motors; Braintree and Cohasset, two 48½-ton four-motor combination cars. Open 33-ton motors seat ninety-six passengers; four-motor combination cars seat forty-five to fifty passengers. *B.* Four at one time. Open motors weigh 66,350 lbs. Seat ninety-six. Closed motors weigh 81,000 lbs. Seat about seventy. *C.* Two. Weight, total, 50,000 lbs. Seating capacity, forty. *D.* Three. Weight, 52,000 lbs. Fifty passengers. *E.* Three. Weight 97 tons each.

74. Give the rated horse-power of the locomotives or motor cars?

A. Two motor equipments (open cars), 350 hp; four motor equipments (combination car), 700 hp. *B.* 350 hp. *C.* Rated horse-power, 320. *D.* 200 hp. *E.* 1000 hp each.

75. What is the general arrangement of the mechanism? i. e., the type and number of motors per car. The power of each motor, its revolutions per minute at normal speed, and its weight?

A. Two "G. E. 55" motors on one truck of two motor cars, and on each truck of four motor cars. Rating of G. E. 55 motors, 175 hp at 550 volts. Revolutions per minute, 700 to 1000. *B.* Two motors per car. G. E. 55. Both on one truck. Rated 175 hp. Each weighs 5000 lbs. and runs about 1000 r. p. m. at normal speed. *C.* Two motors on one truck, of type G. E. 55. Each motor rated at 160 hp at 500 volts. Normal speed, 760 r. p. m. Weight with gears and gear covers, 5415 lbs. *D.* Westinghouse special. One car has four 50-hp motors, one on each axle, and two have two 100-hp motors each, one on each truck. 1000 r. p. m. at speed. Weight, about 3500 lbs. *E.* Four motors per locomotive, 250 hp each.

76. The number of trucks and the number and diameter of wheels under the car and the number of wheels used for traction?

A. Two. Eight 36-ft. wheels. Two motor equipment four wheels, four motor equipment eight wheels. *B.* Two trucks. Eight 37-in. wheels, four of which are used for traction. *C.* Two trucks. Diameter of wheels, 36 ins. Number of driving axles, 2; number of driving wheels, 4. *D.* Two trucks. Eight 36-in. wheels. Car with four 50-hp. motors uses every wheel. Other use one pair in each truck. *E.* Two trucks. Diameter of wheels, 62 ins. All wheels used for traction.

77. Are the motor armatures mounted directly upon or geared to the axles?

A. Single reduction gearing. *B.* Geared. *C.* Geared. *D.* Geared to the axles. *E.* Mounted on axles.

78. Give diameter of driving axles?

A. 6½ ins. *B.* Gear fittings 8 ins. diameter; wheel fittings and motor journals, 6½ ins.; journals, 5½ ins. x 9 ins. *C.* Diameter of driving axles, 6½ ins. *D.* 5¼ ins. *E.* 8 ins.

79. Give total weight on driving wheels, i. e., weights available for traction?

A. Two motor equipments, 38,500 lbs.; four motor equipments, 97,000 lbs. *B.* 39,600-lb. open cars; 47,000-lb. closed cars. *C.* 36,000 lbs. *D.* About 52,000 lbs. *E.* 97 tons.

80. Describe the winding of the motors?

A. Series wound. Armatures, 1 turn; field spools, large, two of 62 turns each; small, two of 29 turns each. *B.* Four-pole series drum winding. *C.* Motor series wound four field coils in series. Armature, 1 turn; large field spools, 62 turns each; small field spools, 29 turns each. *D.* Westinghouse special.

81. Are the motors supported in any manner by the truck frames?

A. No. *B.* No. *C.* Motors are supported on spring nose plates, resting on independent equalizer bars, spring suspended from motor frames beneath axle journals. *D.* Yes. *E.* Yes.

82. Describe the motor suspension?

A. Motors are supported on spring nose plates resting on independent equalizer bar springs suspended from the motor castings under the axle journals. (See Fig. 14.) *B.* Two heavy bars supported by links at each end attached to motor frame at axles, extending from one axle to the other. Back of motors rest on these bars. *D.* The back of the motor is supported by the cross frame of the truck, and the front of the motor by the axles. *E.* Springs and cushions.

83. Are any special facilities provided for in the design of the motors or trucks for rapid exchanging of parts, such as replacing an armature or other repair work?

A. Truck frame may be lifted clear of the motors, wheels and motor equalizer bars; or motors may be lifted out of the truck after rolling out from under cars. *B.* Truck frame can be lifted off, leaving wheels, axles and motors with the suspension free to be exchanged for others or repaired. *C.* Body of truck may be lifted off, leaving motors on independent equalizer. Motor with its pair of wheels may be readily detached, or motor lifted out independently. *D.* Casings are divided in two parts, one part lowering to allow armature to be taken out. *E.* No.

84. What provision is made for ventilating the motors?

A. Gauze covers are in trial. In hot weather motors are run with covers removed. *B.* Three hand-holes with covers of wire netting. Also large cover over commutator with netting. *C.* Motors are run with screen ventilating covers, or with covers removed. *D.* Usual ventilating holes. *E.* Nothing unusual.

85. What is the system of control?

A. Series parallel. *B.* Series parallel. *C.* Series parallel. D. Westinghouse special controllers. *E.* Series parallel.

86. Describe the controlling apparatus?

A. A series parallel controller of type G. E. L. 2 is placed on each platform, and connected with motors and resistance boxes under cars. *B.* G. E. L. 2 controller. *C.* A series parallel controller of type G. E. L. 2 on each end of car, in vestibule. *D.* As above. *E.* Contacts mounted on revolving cylinder; blow-outs (magnetic) on side.

87. What is the form and material of resistance?

A. Resistance boxes built up of wrought-iron tape stampings of type P. R., G. E. Co. are used. *B.* Packed iron ribbon. G. E., P. R. resistance. *C.* Resistance boxes of iron tape; type P. R., G. E. Co. *D.* Diverters. *E.* German silver strip.

88. What system of braking power is used? Is it satisfactory?

A. Westinghouse automatic air, using Christensen motor-driven compressor and compressor controller. It is satisfactory. *B.* Westinghouse automatic air. Independent motor compressor. Yes. *C.* Westinghouse brake cylinder and triple valve; Christensen engineer's valves; "automatic air." *D.* Westinghouse air. Yes. *E.* Westinghouse air-brake system. Satisfactory.

89. Describe the alarm signals used—whistles or bells, and how operated?

A. Gongs of standard locomotive bell weight are attached to hand rails on ends of cars, and three-note chime whistles blown by air. *B.* Large 18-in. gong, worked by the foot. Large chime whistle, blown with 80 to 90 lbs. compressed air. *C.* Gongs of standard locomotive bell weight, and air whistles of three-note chime. *D.* Engine bell on top of car. *E.* Whistles operated pneumatically. Bells used, pulled by hand.

90. Describe the current-collecting devices used on motor cars?

A. All motor cars are fitted each with two overhead trolleys and two third-rail shoes. Trolley poles of tapered steel tube are held up by spring tension of 28 to 30 lbs. Wheel is 5 ins. diameter, made up with composition body and steel flanges, giving square groove and flat tread. Shoes are of cast iron, supported by cast-iron links under each king-pin, giving a contact surface of 14 ins. x 2½ ins. and resting on rail of their own weight. *B.* Cast-iron shoes about 14 ins. long and weigh about 28 lbs., supported by links from an insulated support. Two per car. *C.* 15-ft. steel trolley arms carrying special 5-in. wheel made up with composition hub and steel flange: groove wide and straight; tread square. *D.* Trolley wheel and carbon brushes. *E.* Brass shoes, two in series, about 24 ins. long and 5 ins. wide, pointed at either end.

91. Describe the method of heating and lighting?

A. Heating during the months operating this system is unnecessary. All cars are lighted by 16-cp incandescent railway lamps, connected up in series groups of five or six lamps. *B.* Electric heaters of resistance wire embedded in enamel. Lights are 16-cp incandescent, wired, 6-in. series, twenty-four to thirty per car. *C.* Heating by "National" electric heaters. Lighting by 16-cp incandescent lamps. *D.* Electrical. *E.* No heat. Light taken from motor circuit.

92. Are any special devices used on motor cars for the removal of snow from the track, or snow and sleet from the conductor rail or trolley wire?

A. No. *B.* Snow plows under car platforms with rattan brushes on lower edge. Also steel brushes on conductor rail. *C.* No. *D.* Pilot of motor car and sleet wheel on wire. *E.* No.

OPERATION

93. Give the number and style of cars and total weight of each train in ordinary service?

A. Pemberton section, 33-ton, 16-bench, open 2-motor cars in regular half-hour service. Average weight of train of one open motor car and two open trailers, 60 tons. Braintree section, half-hour service, same as above. Heavy work, two trains of one 48½-ton motor car and two or three 30-ton coaches each. Average weight, 130 tons. *B.* Ordinary service, motor car and one trailer. Summer train weighs about 46 tons. Winter train, 70 tons. *C.* One motor car of 50,000 lbs. weight, one or two coaches of 29,000 lbs. weight each, one or two open trailers seating seventy passengers, of about 27,000 lbs. weight. *D.* Three motor cars. From 52,000 to 156,000 lbs., about. *E.* Ordinary freight train weighs about 1400 tons Standard car.

94. Give the time schedule and distance each train is run?

A. Pemberton to Braintree, 15.7 miles, schedule time 51 min.; Cohasset to

Braintree, 11.5 miles, schedule time, 34 min. *B.* Hartford to Bristol, 18 miles in 40 min., five stops. Berlin to New Britain, 3 miles, 7 min., no stops. *C.* Distance, 7.66 miles; schedule time, 17 to 20 min. *D.* About 20 min; 7.1 miles. *E.* No schedule. Trains run 4 miles.

95. The normal speed on the level and on grades?

A. 60-ton trains on level, about 40 miles per hour; 60-ton trains on grades, from 30 miles per hour up; 130-ton trains on level, 35 miles per hour; 130-ton trains on grades, 25 miles per hour up. *B.* On level, 35 to 40 miles per hour. Down grade, 50 to 60. Up, 15 to 20. *C.* 3 miles per hour on level; 25 to 30 per hour on grades. *D.* About 21 miles per hour. *E.* Speed on level, 15 miles per hour; on grade, 10.

96. The maximum number of motor cars or trains which can be run at one time?

A. Twelve trains of varying weight. *B.* About six ordinary trains. *C.* Two. *D.* Three. *E.* One.

97. The average amount of power consumed by each train at average speed, in kilowatts measured on the car?

A. 60-ton train, 75 kw-hours; 130-ton train, 150 kw-hours. *B.* 75 kw. *C.* Average 70 kw. *E.* No recording device.

98. The number of kw-hours per train mile measured on the car?

A. 60-ton train, 3.0 kw-hours; 130-ton train, 5.2 kw-hours. *B.* About 2½ kw-hours for the ordinary train. *C.* Stamford to New Canaan, 2.9; New Canaan to Stamford, 1.25. Average, 2.10 kw-hours. *E.* 14 approximate.

99. Watt-hours per ton mile?

A. 30-ton train, 50 watt-hours; 130-ton train, 40 kw-hours. *B.* 50 to 75. *C.* Stamford to New Canaan, 80; New Canaan to Stamford, 39. Average, 59.5 kw-hours. *E.* 36.6.

100. Give total cost of power per kw-hour?

A. 0.007575. *B.* 1 cent. *C.* $0.0119. *E.* Between 6 and 7 mills.

101. Give cost of fuel only per kw-hour?

A. 0.00260. *B.* $0.004. *C.* 0.00208. *E.* 2¾ mills.

102. Give cost of water only per kw-hour?

A. 0.000382. *B.* $0.0006. *C.* 0.00058. *E.* 1-3 mills.

103. Cost of labor at power station per kw-hour?

A. 0.00422. *B.* $0.0043. *C.* 0.00565. *E.* 3 mills.

104. Give cost of maintenance at power station per kw-hour?

A. 0.000373. *B.* $0.0015. *C.* 0.00290. *E.* 3-10 mill.

105. Cost of maintenance of motor cars per car mile?

B. 0.018. *E.* $0.08 approximate.

106. Cost of labor in operation of trains per mile?

A. 0.0728. *B.* 0.034. *C.* 0.0593.

107. How many hours per day is each power station in operation?

A. 18. *B.* 18 hours. *C.* 18 to 18½. *E.* 24 hours.

108. How many men are required to operate each station?

A. 8. *B.* 9. *C.* 6. *E.* 28.

109. Number of shifts?

A. 2. *B.* 2 (Firemen 3). *C.* 2. *E.* 2.

110. Number of men in each shift?

A. 4. *B.* 4. *C.* Four on day shift, two on night shift. *E.* Sixteen day, twelve night.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED AUG. 28, 1900

656,635. Electric Motor Suspension; G. Gibbs, Philadelphia, Pa. App. filed Feb. 28, 1898. The motor is hinged upon the axle, the field magnet being arranged on one side thereof, and an extension from the frame projecting from the other side. A cradle supports the motor, a spring being inserted between the cradle and the projection.

656,636. Electric Motor Suspension; G. Gibbs, Philadelphia, Pa. App. filed May 11, 1900. A modification of the preceding patent.

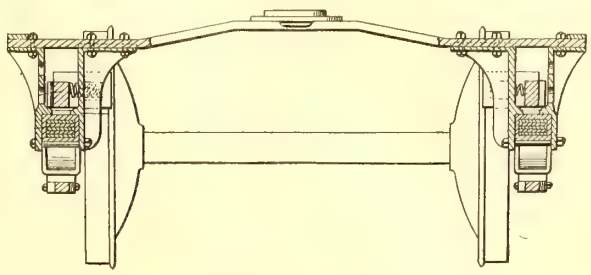
656,753. Railway; J. Sparrow, Reading, England. App. filed July 11, 1899. According to this invention cars can be moved from a double track onto a single track without the use of movable switches, the invention consisting in a special construction of rail flanges and shoulders.

656,878. Car truck; J. A. Brill, Philadelphia, Pa. App. filed May 15, 1899. Consists in a construction whereby the usual bolster-transoms which extend between the side frames are dispensed with, and said transoms formed by inwardly extending brackets either secured to or formed integrally with the side frame.

656,885. Radial Car Truck; J. P. Faye, Binghamton, N. Y. App. filed March 17, 1898. The axles and wheels are mounted in frames, which are connected together by toggle levers.

656,900. Car Truck; J. L. Levy, New York, N. Y. App. filed Sept. 14, 1897. This construction provides for extending the bolster suspension or spring base closely adjacent to the axle-box pedestals, in order to give a greater spring base for the support of the car body on the truck.

656,935. Fare Register; W. L. Brownell, Elizabeth, N. J. App. filed Nov. 12, 1897. The invention consists in an arrangement whereby the bell-hammer is protected against any disturbance whatever until after the return stroke of the pulling-pawl is fully completed, the bell hammer receiving the necessary impulse to ring the bell while the head of the pawl is in the act of dropping behind a newly advanced ratchet-tooth preparatory to the next registration, the object and effect being to render it both theoretically and practically impossible to ring the bell more than once for each registration of a fare.



PATENT NO. 656,878

656,986. Construction of Railroad Tracks; G. Lindenthal, New York, N. Y. App. filed July 20, 1899. Longitudinal sleepers for railroad tracks, consisting of successive sections and of splice plates joining the sections longitudinally, and having ends bent downward and transversely to the line of the longitudinal sleepers.

ENGINEERING SOCIETIES

CENTRAL RAILWAY CLUB.—The next regular meeting of this club will be held on Friday, Sept. 14, 1900, at 10 a. m., at the Hotel Iroquois, Buffalo, N. Y. The executive committee will meet at 9 a. m. Prof. Gaetano Lanza, of the Massachusetts Institute of Technology, will read a paper upon "Efficiency Tests of Locomotives." The following reports by special committees, submitted at the May meeting, will be discussed: "Best form of construction, and methods of ventilating, heating and general equipment of roundhouses." Committee: W. H. Marshall, chairman; George W. West, C. H. Potts. "Standard box cars; technical details of construction along the lines recommended by the committee on typical dimensions whose report was presented at the January meeting." Committee, L. T. Canfield, H. F. Ball.

PERSONAL MENTION

MR. H. S. COOPER has resigned as general manager of the Ithaca, N. Y., Street Railway, to take effect Oct. 1. Mr. Cooper was born in Isle of Wight, England, in 1856, and came to America in 1865. He was educated at Farum School, Beverly, N. J., and worked as clerk and salesman in Philadelphia from 1870 to 1876. In the latter year he engaged in the manufacture of agricultural machinery at Raleigh, N. C., and Jacksonville, Fla., and in connection with this had charge of the electrical work on two lines of steamers on the St. Johns River, and of considerable work in the two lighting stations in Jacksonville at that time. In 1893 he accepted the managership of the Schenectady properties of the Electrical Development Company, later the Schenectady Railway Company, which position he resigned in 1899.

NEWS NOTES

(Readers will confer a favor by sending us news for this department.)

MONTGOMERY, ALA.—The street car ordinance providing for the separation of the white and black passengers on street cars has caused an eruption here. The negroes have held mass meetings and have declared a boycott on the company.

SELMA, ALA.—W. R. Hall has been engaged to superintend the conversion of the Selma Street & Suburban Railway from a mule to an electric line. Mr. Hall is now looking over the routes and preparing an estimate of the cost of construction. Mr. Hall succeeds Mr. Marion as superintendent of the company, and the latter will go with the Birmingham, Selma & New Orleans Railroad, which owns the Selma property.

COLORADO SPRINGS, COL.—The Colorado Springs Rapid Transit Railway Company has entered into a contract with the Colorado Springs Electric Company for obtaining power to operate its lines from the plant of the latter company for a period of five years.

NEW HAVEN, CONN.—The Fairhaven & Westville Railroad Company has reduced the fare to East Haven from 10 cents to 5 cents.

NEW HAVEN, CONN.—It is understood that the United Gas Improvement Company, of Philadelphia and New York, will apply next year for a franchise to extend the electric railway lines now terminating at Woodmont to Savin Rock and New Haven via either Davenport Avenue or Washington Street.

WASHINGTON, D. C.—The Washington & Gettysburg Electric Railroad Company, which was granted a franchise last September by the Board of Aldermen, of Frederick, Md., for the use of the streets of Frederick, has secured an extension of time in which to begin work on the road until April 30, 1901.

SAVANNAH, GA.—The Savannah, Thunderbolt & Isle of Hope Railway Company has petitioned the Council for permission to make a number of minor changes in the operation of its lines, and for permission to double-track one line for a short distance.

CHICAGO, ILL.—The street railway companies operating here have been notified to have their cars equipped with vestibules by Nov. 1.

CHICAGO, ILL.—Two bills will be presented at the next session of the Legislature looking to the protection of the city's interests, whether the present system of surface terminals in the downtown district is maintained or a subway scheme substituted. In each bill provisions will be made for the eventual control of at least the tracks and right of way by the city. The Street Railway Commission all along has shown no disposition to favor the scheme of owning the rolling stock, because of the immense amount of detail involved. The Aldermen have taken the position that with the proprietorship of the rails the city could eventually lease them to the highest bidder and stipulates as one of the conditions that poor service would be due cause for the abandonment of the contract.

KOKOMO, IND.—The City Council of Elwood has passed an ordinance granting the Central Traction Company, of Indiana, a franchise for the construction of an electric railway from Elwood to Tipton. The franchise is to run for fifty years, and the company is required to have the road in operation by Jan. 1, 1902.

INDIANAPOLIS, IND.—The Indianapolis, Greenwood & Franklin Electric Railway and the Indianapolis & Greenfield Rapid Transit companies have signed the interurban franchises submitted to them by the Board of Works, granting the right to operate over the lines of the Indianapolis Street Railway Company.

PARIS, KY.—Local capitalists have just been granted a franchise for the construction of an electric railway here. The franchise stipulates that construction work be begun within a year, and that the road be completed within two years. H. A. Power, of Paris, is interested in the enterprise.

ROCKVILLE, MD.—At the special election held here a few days ago the action of the Town Council in granting a right of way over Montgomery Avenue to the Washington & Rockville Electric Railway Company, was upheld.

PALMER, MASS.—A collision occurred on the Palmer & Monson Street Railway Aug. 26. Several persons were slightly injured.

LEXINGTON, MASS.—The Lexington & Boston Street Railway Company has made application to the Council for franchises for four lines—two between the Lexington and Lincoln lines, and two between the Lexington and Woburn boundaries.

LEXINGTON, MASS.—Both the Boston & Concord Street Railway Company and the Lexington & Boston Street Railway Company have applications for a franchise pending here, and there are prospects of a bitter fight in Council.

GRAND RAPIDS, MICH.—The Council has passed an ordinance granting the Grand Rapids, Spring Lake & Grand Haven Electric Railway Company a twenty-year franchise for the construction of an electric railway through the city.

ST. LOUIS, MO.—An entire new equipment of cars was placed on the Northern Central division of the St. Louis Transit Company Aug. 30.

ST. LOUIS, MO.—The smoke-stack on the power house of the St. Louis Transit Company at Park and Vandeventer Avenues was blown down during a wind storm last week. It was 155 ft. high and the tallest in the city.

ST. LOUIS, MO.—The St. Louis County Court has granted the St. Louis, Fenton & Southwestern Railway Company an extension of time, till Jan. 1, to begin work on its proposed railway. This is the fourth time an extension of time has been granted.

SYRACUSE, N. Y.—The office of the Syracuse, Lakeside & Baldwinsville Electric Railway Company was entered by thieves Aug. 28 and robbed of $6000 in bonds and about $300 in cash.

SYRACUSE, N. Y.—The extension of the lines of the Syracuse & Suburban Railroad from Edwards Falls through Delphi to Reruyter is again being agitated.

BUFFALO, N. Y.—Local manufacturers and merchants are discussing a plan for having the street railway company transport freight from the receiving yard in the regular freight car direct to its destination. It is not known whether the plan has been laid before the street railway managers, but it is deemed impracticable. The franchise held by the company at the present time contains no provision covering the operation of freight cars as mentioned, and there would be considerable interference with general traffic. This the public would not tolerate.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company is testing a new style car for the purpose of securing more seating capacity and at the same time have more standing room for heavy traffic. The cars are provided with individual seats, two abreast. They are arranged in such manner that they both slant backward toward the center, forming the letter V. Thus an aisle through the center allows much standing room and enables fifteen more passengers to be seated than on an ordinary car.

KINGSTON, N. Y.—The Peckham Manufacturing Company, of Kingston, was incorporated Aug. 29, with a capital of $500,000, to manufacture motors, car trucks and wheels. The company is to succeed to the business of the Peckham Motor, Truck & Wheel Company. The directors are: James H. Everett, V. B. Van Wagonen and Hewitt Boyce, of Kingston; Frank M. Jeffrey, George H. Bowers, William E. Davis and William Wampler, of New York City.

ASHEVILLE, N. C.—The Asheville & Weaverville Electric Railway & Power Company has been reorganized and the following new directors elected: Don. J. Barnes, John R. Baird, John M. Ramsey, O. D. Revell, of Asheville; J. B. Lotspeich, Edward F. Vandiver and W. E. Weaver, of Weaverville. The company has a thirty-year franchise for the construction of an electric railway in Asheville.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company is preparing to introduce an ordinance in the City Council for a franchise for a single-track line from Tod and Fremont Streets, westerly on Fremont Street to Skinner Street, and northerly on Skinner Street to Tod Street. This will give the company a complete loop, and will enable cars to pass Harvard Grove Cemetery.

FREMONT, OHIO.—The Toledo, Fremont & Norwalk Electric Railway Company has secured a private right of way alongside of the Lake Shore and the W. & L. E. R. R. tracks from the west line of Monroeville to where its line crosses the Bellevue & Monroeville road, just east of Bellevue.

MARION, OHIO.—Right of way is now being secured for the construction of an electric railway from Marion to Prospect. The line is to extend through Green Camp. Among those interested in the new enterprise are: O. Wollenweber, D. R. Crissinger, French Crow, F. E. Guthery, J. W. Scott and Charles Hofstetter, of Marion.

COLUMBUS, OHIO.—The Columbus, London & Springfield Traction Company has been granted a franchise for the construction of its proposed line through West Jefferson.

NEWARK, OHIO.—The Newark & Granville Street Railway Company has been incorporated under the laws of Delaware to construct an electric railway in Newark, Ohio. The capital stock of the company is $300,000.

COLUMBUS, OHIO.—The Columbus & Johnstown Traction Company has made application to the Council for a franchise granting the company permission to enter Columbus over the lines of the Columbus Railway Company. The ordinance contains provisions for a 5-cent fare, six tickets for 25 cents and twenty-five tickets for $1. The term of the franchise is to be twenty-five years.

SPRINGFIELD, OHIO.—S. L. Nelson, of Wichita, Kan., formerly manager of the Springfield Street Railway, has brought suit against the latter company for $72,750, with interest, for services rendered in negotiating the purchase of certain Dayton property. The suit was originally entered against the American Railway Company, which owns the local lines, the latter suit being merely a method to overcome certain technicalities.

ZANESVILLE, OHIO.—The County Commissioners of Muskingum County have granted the Zanesville, Adamsville & Coshocton Electric Railway Company a franchise authorizing the construction of an electric railway over the county roads from Zanesville to Coshocton by way of Sonora, East Greenwood, Adamsville, Otsego, Plainfield and West Lafayette. The company binds itself to build the line within two years, and to leave the highways in good condition. The preliminary survey will be made as soon as the franchises through the villages and into the cities are granted.

LORAIN, OHIO.—A lively electric railway war is on in this city. Some time ago the Council granted the Cleveland, Elyria & Western Electric Railway Company a franchise for a single-track electric railway on West Erie Avenue. The Sandusky & Interurban Railway was also given a franchise for a double-track road on the same street. At a meeting of the companies and the city officials no agreement could be reached as to which company should build the tracks and own them, or which should occupy the center of the street. Last week the Sandusky Company constructed a double-track road from the center of the city to the town line. The Cleveland, Elyria & Western Electric Railway Company then laid a third track at the side of the street. The City Council is trying to find a way out of the dilemma.

PITTSBURGH, PA.—The Southern Traction Company is now being organized by Matthew K. McMullin, C. L. Magee, William Flinn, T. H. Given, J. D. Calley, James H. Reed and Joshua Rhodes, to take over the West End Traction Company, which was recently purchased by Mr. McMullin. It is said that the ultimate intention of the company is to merge all the lines south of the Monongahela River.

MEDIA, PA.—The Delaware County Commissioners have granted the Philadelphia & Delaware Trolley Company and the Prospect Street Railway, of Chester, permission to build two bridges on the Island Road, along the river front, between Philadelphia and Chester. One of the bridges will be erected over Darby Creek, in Tinicum Township, and one will span Crum Creek, in Ridley Township. The former will be 480 ft. long and the latter 100 ft. Each will be 26 ft. wide and both will be draws. They will cost about $60,000.

PORTSMOUTH, R. I.—The Gibbs Electric Signal Company has recently been organized under the laws of Rhode Island, with a capital of $50,000, for the purpose of manufacturing and selling automatic block signals, semaphore telephone signals and telephones. Harry T. Gibbs, general manager of the company, was formerly with the General Electric Company at Boston.

PROVIDENCE, R. I.—The United Traction & Electric Company has completed and placed in operation its new line between Providence and East Greenwich.

EL PASO, TEXAS.—Frederick E. Smith and Francis Seiberling, of Akron, Ohio, are in El Paso negotiating for the purchase of a franchise held by local parties for the construction of an electric railway here. Mr. Smith is vice-president of the Second National Bank, of Akron. He has announced that should the franchise be secured, a road will be in operation within a year.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

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St. Louis Strike Called Off

In a mass meeting held Sept. 12 the striking street-car employees of the St. Louis Transit Company adopted resolutions calling off the strike and boycott against the company, and furthermore declared that any member of the union applying for work to the transit company would not endanger his membership thereby. The strike was ordered May 8, and called off on July 2. A week later it was reordered and the boycott imposed.

Electrical Equipment of New York Elevated Roads Delayed

The non-arrival of materials at expected times has seriously interfered with the work of electrically equipping the lines of the Manhattan Railway Company, and it is not known definitely when a trial of the system can be made on the Second Avenue line, on which work is most advanced. The work will be pushed with all possible speed, and a trial made at the earliest moment.

Yerkes Will Build a Road in London

A cablegram from London announced that Charles T. Yerkes, of Chicago, has purchased the franchises and all the rights of the Charing Cross, Euston & Hampstead Railroad, and that an American syndicate is to be formed to build a tunnel road under the streets from Charing Cross, in the heart of London, to Hampstead Heath, 4½ miles, and also an extension of 2 miles from Camden road to Kentish town. It is estimated that it will cost $12,000,000 to build the road. There is a large tract of land surrounding the suburban terminus of the new line, which has never been developed, and between this and the city is a high plateau over which no surface road has yet been built. The new road, as projected, is to pass under the plateau and emerge on the level track beyond, bringing this section within easy reach of the center of London. Electricity is to be used as motive power, and it is said that four tracks will be laid, two for express and two for local trains. Ten stations will be built. D. H. Louderbach, who was associated with Mr. Yerkes in his Chicago enterprises, and Henry C. Davis assisted Mr. Yerkes in completing the deal.

Street Railway Suggestions Officially Invited by the Chicago Street Railway Commission

The Chicago Street Railway Commission has made public a list of questions regarding the traction situation in that city on which it desires to receive suggestions from the residents of the city. This plan of submitting the questions to the public has previously been mentioned in the STREET RAILWAY JOURNAL, and in our last issue mention was made of the decision of the Commission to submit the question to the public. The people are asked:

"If public interests require the consolidation of all street railway lines under one management.

"If it should be the policy of the city to treat the street railway business as a monopoly.

"If franchises granted hereafter should contain a provision giving the city the right to take over the property at an appraised valuation.

"If they would prefer continuous car routes, passing through the heart of the city, in preference to the present system of downtown terminals.

"If they favor city ownership of tracks without city ownership of power plants or rolling stock and with city operation, or if they favor the policy of municipal operation either in the near future or ultimately.

"If the city, in granting franchises, should prescribe a minimum wage or a maximum working day for employees, and, if so, what they should be.

"If the city, in granting franchises, should require the traction companies to submit labor disputes to arbitration to avoid interruption in service.

"If they favor a system of subways or underground roads in the down-town district, making possible the removal of all cars from the surface."

The Commission requests that the views of the writer in each case be set forth in his own language, and be not confined to yes or no answers to the questions. It is not expected that every person will attempt to answer all the questions. The compilation, which will be made of the answers received, will be used both in measures recommended to the Council by the Commission and in bills which will be prepared for the Legislature. It is the intention to frame two measures for the General Assembly, one a grant of power relating to franchises and the other to the subway.

The Convention of the New York State Street Railway Association

As previously announced in this paper, the eighteenth annual meeting of the Street Railway Association of the State of New York will be held at Buffalo on Tuesday and Wednesday, Sept. 18 and 19. The meeting will be held at the Iroquois Hotel, and the following programme, which has been made up by President Rogers, has been decided upon:

TUESDAY, SEPT. 18

9:30 a. m.—Meeting of the Executive Committee.
10:30 a. m.—Meeting of the Association.
1. Call of the roll.
2. Approval of the minutes.
3. Address of the President.
4. Report of the Executive Committee.
5. Minutes of the special meeting of the Executive Committee.
6. Report of the Treasurer.
7. Reading of papers on practical street railway questions by well known gentlemen, names and subjects to be announced.
8. Discussion ensuing.
9. General business.
a. Appointment of Nominating Committee.
b. Nomination of officers.
c. Election of officers.
d. Selection of place of next meeting.

The entertainment of the attendants in the afternoon has been arranged for by the local committee, and includes a visit to the Pan-American Exposition grounds, by special invitation of William I. Buchanan, director general, and an inspection of the transforming storage battery stations of the Buffalo Railway Company. At 8 p. m. the annual banquet will be held at the Iroquois Hotel.

WEDNESDAY, SEPT. 19

9:30 a. m.—Second session of convention.
1. Unfinished business.
2. Reading of papers and discussion ensuing.
11:30 a. m.—Entertainment as arranged by local committee. This will include a trip by special cars of the International Traction Company, Buffalo and Lockport division, from the Iroquois Hotel, over the Buffalo division, Main Street line and the Buffalo and Lockport division, to North Tonawanda. The regular running time from Buffalo to North Tonawanda is at the rate of 50 miles per hour. At North Tonawanda an inspection will be made of a 35-ton electric locomotive drawing freight trains. Thence the party will proceed over the Niagara Falls division of the International Traction Company to Niagara Falls, where an inspection will be made of the power house (50,000 ehp) of the Niagara Falls Power Company, by special invitation of the power company. At this power house will be seen the transforming station from which high and low tension currents are transmitted for local manufacturing and smelting purposes, and 15,000 ehp at 11,000 volts, is transmitted to Buffalo. The party will then go by special cars across the upper steel arch bridge of the International Traction Company and over this company's Canadian division to visit Table Rock and the Dufferin Islands, by special invitation of James Wilson, superintendent of Queen Victoria Niagara Falls Park.

At 2 p. m. luncheon will be served at Dufferin Café.

At 3 p. m. the party will proceed by special cars over the Canadian division of the International Traction Company to Brock's Monument to visit the battlefield of Queenstown Heights, and will return to the American side over the International Traction Company's suspension bridge at Lewiston. The cars will then run over the Great Gorge route to Niagara Falls; thence over the Niagara Falls division of the International Traction Company to Buffalo, returning to Buffalo in time to take evening trains for New York and other eastern points. By special invitation of Godfrey Morgan, general manager of the Great Gorge route, a special searchlight expedition to Whirlpool Rapids has also been arranged for delegates and guests on this evening.

It is expected that some ten or twelve papers will be prepared and read, treating everyday, practical street railway subjects of vital importance and interest to street railway men generally. The exhibit feature promises to be larger and more pretentious than ever before, and the attendance of supply men much greater then at previous conventions. The following are the papers, together with their authors, definitely decided upon at this time:

"Power Distribution in Buffalo," by C. K. Marshall, electrical engineer of the Buffalo Railway Company.

"Rotary Transformers," by R. E. Danforth, superintendent of the Buffalo Railway Company.

"Storage Batteries," by Thomas Henning, superintendent of the power house, Buffalo Railway Company.

"Test of the Buffalo Railway Power House," by Prof. Norris, of Cornell University.

"Practical Experience in the Operation of Combined Public Franchises by One Company—Its Advantages to the Public and the Corporation," by C. E. Uebelacker, general manager of the Elmira Municipal Improvement Company.

"The Storage Battery—Its Use on Smaller Roads," by B. B. Nostrand, Jr., president Peekskill Electric Light & Power Company, Peekskill, N. Y.

It is also expected that papers will be prepared and read by representatives of the Metropolitan Street Railway Company, Brooklyn Rapid Transit Company, and by other prominent street railway gentlemen from various parts of the State, but the subjects of these papers have not yet been announced. The following topics for discussion or papers have, however, been decided upon:

Track Bonding.
The Third Rail.
The Repair Shop.
Induction Motors.
Care of Dynamos.
Car Mileage Record.
Indemnity Insurance.
Municipal Ownership.
"The Metallic Circuit."
Store Room Accounting.
The Three-Phase System.
Street Railways vs. State.
Loss of Current in Returns.
General Track Construction.
Employes' Benefit Associations.
"Receipts from Other Sources."
Transfers—Their Use and Abuse.
Street Railways vs. Automobiles.
Points on Overhead Construction.
Rotary Transformers. (Allotted.)
Long Distance Power Transmission.
Low Joints—How to Prevent Them.
Suggestions on Financial Organization.
Maintenance and Repair of Car Bodies.
Pleasure Resorts as Traffic Stimulators.
Signal Systems for Single Track Roads.
Air and Power Brakes for Electric Cars.
Reading and Club Rooms for Employees.
Care and Inspection of Wheels and Axles.
Power Distribution in Buffalo. (Allotted.)
Why Rates of Fare Should Not be Reduced.
The Selection and Management of Employees.
Care and Inspection of Motors and Equipment.
Amusements and Special Attractions for Parks.
The Power Station, from an Economic Standpoint.
How Can We Increase the Efficiency of Employees?
The Best Methods for the Prevention of Accidents.
The Relations of Municipalities vs. Street Railways.
Hints on Making Small Electric Railways Profitable.
Compressed and Liquid Air for Street Car Operation.
Storage Battery—Its Use on Small Roads. (Allotted.)
Mail, Freight and Express Service on Electric Railways.
Electrically Welded Joints in Actual Operation. (Allotted.)
Practical Experience with Double-Deck and Convertible Cars.
Removal of Snow and Ice—The Most Economical and Efficient Methods.
Single and Double Trucks—Their Relative Advantages and Disadvantages.
Practical Experience in the Operation of Combined Public Franchises by One Company—Its Advantages to the Public and the Corporation. (Allotted.)

Ample space has been arranged for at the Iroquois Hotel for exhibits, for the benefit of those manufacturers who desire to make them, and the president and executive committee of the association wish it generally understood that a most cordial invitation is tendered to all manufacturers of street railway apparatus and their representatives to attend the convention, whether they make exhibits or not.

In this connection it may not be amiss to refer to the admirable record made by the association during recent years. That this record, which has been followed by a greatly increased growth and influence, is due largely to the untiring efforts and ability of President Rogers and Secretary Robinson, is a fact generally recognized by those who have been closely following the history and acts of the association. It is a body which is exercising a great benefit to all the street railway companies of the State, and should have the cordial co-operation of all. This is shown not only by the admirable programmes which have been arranged for the different annual meetings, but by hard and persistent work during the year, in which the interests of the street railway companies are conserved in a way only possible by concerted action.

Meeting of the New England Street Railway Club

The New England Street Railway Club held its first regular meeting at the Pathfinder Meeting Rooms, 67 Federal Street, Boston, Wednesday evening, Sept. 5.

The meeting was called to order by President H. E. Bradford, of Marlboro, who spoke as follows: "This is the first meeting of the New England Street Railway Club, which was formed a short time ago at Young's Hotel, Boston. We met there in a social way, but the outcome of the meeting was the formation of the club. I was appointed president, and possibly a mistake was made by the club in choosing me as its first president.

"I think the necessity of such a club will be accepted by all street railway men, as it can do much for the operating man, especially to subordinates, by interchanging ideas. The officials in the transportation department of the Boston Elevated Railway Company, Boston, meet once a week and exchange ideas of operation, and it must be evident that this plan, if followed out, is beneficial. We are not very strong, but all associations in existence started in this feeble way; it is a case where we must put our shoulders to the wheel.

"We were in hopes to have E. C. Foster, vice-president and general manager of the Lynn & Boston Railroad Company, with us to-night, and regret his inability to attend, as he would be a very desirable speaker. However, as we are a little late in getting started it seems advisable that Mr. Stone, of the Electric Storage Battery Company, address the meeting first on 'The Demands for Chloride Accumulators by Street Railways.' There are some who would like to catch trains, and at the same time would be disappointed if they did not hear his remarks."

The Demand for "Chloride Accumulators" by Electric Railways

BY FRANK J. STONE

It is our pleasure this evening, in response to a request from the executive committee of this club, to present to you a few facts and figures relative to the demand for "chloride accumulators" by electric railways. Mr. Davis has prepared for us curves and data which we felt confident would be interesting and instructive, as they will not only explain why the demand for "chloride accumulators" has been so great, but will, I feel satisfied, enlighten you regarding problems which you may possibly have before you at this very time. The very best evidence to enable you to verify these figures and to confirm our statements is that to be secured directly from those who have the battery in operation on their systems, and it is with this end in view that I shall this evening call to your attention the results of our work in actual practice.

Looking back twelve years, when first entering the storage-battery field, and thinking of our early struggles, I cannot but compare our methods and results of that time with what we are achieving at the present day, and I feel deeply gratified with the reward of patient effort. We have all of us, without doubt, I believe, felt the full force and effect of that harsh, but thorough, teacher, experience, and as a result of her teaching we have learned what has hitherto been lacking to increase the efficiency and reliability of the trolley system, and I am proud to say that the Electric Storage Battery Company stands to-day in a position to supply the much-needed type of apparatus.

It would appear, then, that our interests are mutual, and I am glad of this opportunity to give expression to our views as to the value of the chloride accumulator in electric street railway practice, which views you will find are those freely expressed by our patrons. You have but to look upon the countenances of those among you who have become users of the storage battery, and consequently strong advocates of the system, to appreciate the good results that have been attained. For the battery serves well in more ways, perhaps, than in attaining those special ends for which it is designed. While its purchase may be made only with a view to saving fuel or to avoiding the purchase of other apparatus, which at times of light load would be operated under very uneconomical conditions, or to replace copper investment, in addition to these and its many other material advantages, the battery system offers something which cannot be shown in dollars and cents. What I refer to is the advantage of having on hand at all times a reserve supply, and while it would be, of course, impossible for any of us to say what is the value of this, it would be hard to find a user of the battery who has not something of a most favorable nature to say on this point based upon his own experience. We know that interruption to street railway service on Sundays and holidays especially means as a usual thing a heavy loss both in money and prestige. It may not, perhaps, pay to install a plant with this end alone in view, but it is a feature of the system that appeals strongly to all. There is in it a sense of security; you have something laid up for a rainy day; it is always there between your engines and your load, between you and the public; it is a guarantee of the efficiency and reliability of your road.

It is but natural for us to desire to profit by the experience of our neighbors, and to that end also I am bringing to your attention this evening some of the attractive features of such of our installations as I felt would be of interest to you, with some remarks on the experience of their owners. I might say in this connection that in addition to over fifty large Edison central lighting installations we have now in operation more than one hundred street railway plants, the greater number of which have been installed within the past few years. The total capacity of these batteries is approximately 160,000 kw-hours. The railway systems in connection with which they are installed operate over 3000 miles of road.

The Union Traction Company, of Philadelphia, has now in operation six chloride accumulator installations, the first of which is now in its fifth year of service. With this battery you are all no doubt somewhat familiar, from the description given by Charles Hewitt, electrical engineer of the Union Traction Company, in his paper read before the American Street Railway Association in 1897. In this he goes very fully into the subject of the value of the installation to his road. The five other batteries on the road have been installed within a year and remain a standing testimonial to the battery system. The case is simply one where, after having one battery in operation for several years, the traction company has called upon us to install five others, making the aggregate capacity about fifteen times that of the first. It may be interesting to mention that no renewals whatever have been made in any of these plants.

The Woonsocket Electric Machine & Power Company contracted in 1896 for a battery of 400 amps. capacity at the one-hour rate, designed for service on the trolley road, and also for carrying the load of the Edison three-wire system in case of emergency, in the latter case the battery being thrown into two sections in parallel, with the proper controlling devices. In the railway service the battery acts simply as a regulator, taking the place of all generating apparatus that would be required to furnish current above the average demand, and keeping a practically constant load upon the generators in operation by instantaneously responding to the sudden demands incident to the service. The voltage fluctuations at the power house rarely exceed 2 per cent. Although the battery is rated for a discharge of only 400 amps., it is frequently discharged at as high a rate as 600 amps., and at times at over 800 amps. As a reserve, the battery has frequently demonstrated its value. During a breakdown at the station, when it was found necessary to shut down the machinery, the battery carried the entire railway load for some three and one-half hours. No renewals whatever have been made, and the plates are to-day in apparently perfect condition. We have a written statement from L. C. Lincoln, manager of the company, to the effect that during the first year of operation the battery netted them a saving in coal of about 30 per cent, and in labor of $600.

A very novel installation is one that we have recently made for the Brooklyn Heights Railway Company, consisting of 248 cells of type 27-G, weighing approximately 300,000 lbs., and installed in two rows, with an aisle between, upon seven freight cars, six cars having thirty-six cells each, and one car has thirty-two cells and the switchboard. This is for operation at Sheepshead Bay, upon the Coney Island line, and in summer the battery is run out near the end of a long feeder line, and at this point connected up. As the heavy traffic, however, does not last more than three or four months of the year, the battery is hauled back at the season's end to the most advantageous point on the elevated system of the company. This is a case where the battery serves a remarkably good turn, in view of the extraordinarily heavy loads upon the line, with insufficient copper for the maximum during the summer season only. The movable battery solves this difficult problem and saves the interest upon the otherwise necessary investment and the maintenance of either additional feeder or stationary battery for eight or nine months of the year. In operation, it will be seen that the copper as at present installed is amply sufficient with the aid of the battery, this being due to the fact that the battery takes the fluctuations, so that the current upon the line is reduced to the average.

On the system of the Worcester & Suburban Street Railway Company we have installed two chloride accumulator batteries, one at the power house at Leicester, having a capacity of 400 amps. at the hour rate of discharge, with space in the tanks for increasing its capacity by the addition of plates to the extent of 50 per cent. This is a typical station battery, which serves to equalize the load, thus enabling them to shut down one large generating unit, which would otherwise be operating under uneconomical conditions. The other battery is located at Worcester, some 12

miles from the power station, and serves to keep up the potential on the line in that vicinity. The benefit of the battery system in all its force is felt and appreciated in this case, but I will at this time merely call your attention to the improvement in the service on the road which has been experienced since the installations were made. Owing to higher voltage, better speed, closer connections and greater comfort are obtained, and with the finer equipment which it has been found possible to operate, the riding has increased distinctly, and, consequently, the revenue.

On the Woronoco Street Railway system, at Westfield, Mass., we have a station battery in operation which is proving itself a fuel and labor saver. Its use renders possible the shutting down of one engine and the operation of the entire plant, comprising the engines, boilers and battery, by one man, excepting on Sundays and gala days.

The following is a list of the roads in New England using chloride accumulators:

Maine—Sanford & Cape Porpoise Railway Co.; Biddeford & Saco Railroad Co.; Waterville & Fairfield Street Railway Co.

New Hampshire—Union Electric Railway Co., Dover; Laconia Street Railway Co.; Boston & Maine Railroad Co., Portsmouth; Portsmouth, Kittery & York Street Railway Co.; Keene Electric Railway Co.

Vermont—Barre & Montpelier Traction & Power Co.; Bellows Falls & Saxton River Railway Co.; Springfield Street Railway Co.

Massachusetts—Worcester & Suburban Street Railway Co.; Norfolk Western Street Railway Co., Westwood; No. Abington Light & Power Co.; Framingham Electric Railway Co.; Woronoco Street Railway Co., Westfield; Newton & Boston Street Railway Co., Newtonville; Boston Elevated Railroad Co., Chestnut Hill Reservoir.

Rhode Island—Pawtucket Electric Co.; Union Railroad Co., Pawtucket; Pawtuxet Valley Street Railway Co., Riverpoint; Woonsocket Electric Machine & Power Co.; Rhode Island Suburban Railway Co., Riverview; Seaview Railroad Co., Wickford; N. Y., N. H. & H. R. R. Co., E. Providence and Brayton, Mass.

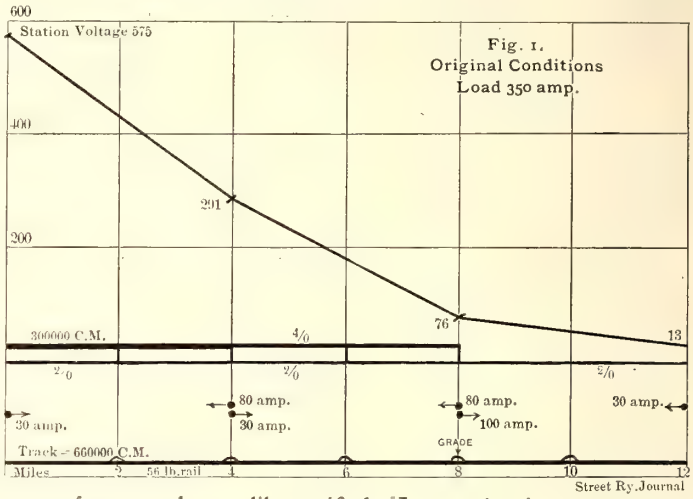
Connecticut—N. Y., N. H. & H. R. R. Co., Hartford and Forestville.

Besides these, many of the principal street railway companies in other parts of the country are using these batteries.

It is rather surprising to me sometimes to hear the company criticised for owning and controlling the exclusive right to manufacture storage batteries, after it has purchased the same (the purchases covering, I believe, over 425 patents). The criticism is a most unjust one, as the Electric Storage Battery Company, by the expenditure of large sums of money and the untiring efforts of its staff, has succeeded in giving to the electrical world a much-needed and very valuable type of apparatus in the form of a commercially successful storage battery, and that at a very remarkable reduction in price. In explanation, I would say that in the chloride accumulator we find a storage battery capable of enduring a discharge rate sufficiently high to totally discharge it in one hour. With the earlier forms, owing to the inability of the battery to discharge at high rates without injury, the purchaser, or rather the inquirer, discovered that he would be obliged to purchase a battery based upon the ten-hour rate, to meet his requirements. For example, if he wanted a battery capable of discharging at the rate of 400 amps., in taking care of the fluctuations on his railway circuit, he would be obliged to purchase one rated for a discharge of 400 amps. for a period of ten hours, or a 4000-amp.-hour battery, which would make the price five times what it need be now. In this regard alone it is plain to be seen what the Electric Storage Battery Company has accomplished in reducing the price to such a figure as to permit of commercial use, and this is one reason why so many chloride accumulator installations are being made at the present day. Aside from this, it must be very comforting when purchasing apparatus to know that you are buying not only the best thing that could be produced in your own country, but the best that the world can afford, for, owing to the existence of an alliance with the largest manufacturers of storage batteries in England, France and Germany, the Electric Storage Battery Company secures the benefit of all past and future improvements.

The plates of the chloride accumulator derive their great advantages over former types from certain remarkable details of form. The conducting grid is made up, not of lead, but of an alloy, which is not in any way acted upon by the acid solution. One result of this is at once apparent, and that is the doing away forever with the troublesome "buckling." The positive plates are so constructed that the effects of the expansion and contraction of the active material are reduced to a minimum, while at the same time this active material is very intimately connected with the conducting grid, and affords a large area to be acted upon without resistance between it and the support. The same structural strength is found in the negative, obtained practically in the same way, while the active material is so prepared as to possess the necessary porosity to a most remarkable degree.

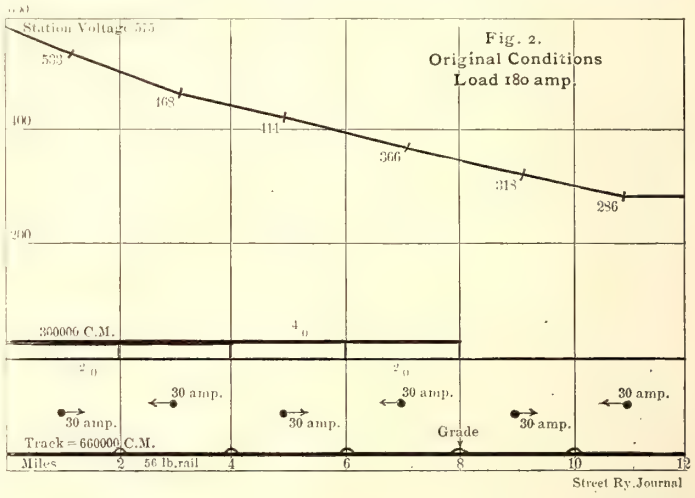
It is the policy of the company in its negotiations with a prospective customer to have the engineer assigned to the case make his report purely from the standpoint of a consulting engineer, and for that purpose I do not hesitate to say that I believe they have selected as able and conscientious a staff as can be found among the fraternity. The report is based upon actual facts as they are found to exist in the situation under investigation, and these facts



can, of course, be readily verified. It contains in most cases a very conservative estimate of the saving to be created and through what sources, with reference also to the other advantages which may be obtained by the application of the battery. There are very few cases where a battery cannot show a saving, especially in street railway work. Regardless of this, however, we are always pleased to be called upon to make an investigation and report, and further, you will please remember that you have all of you a standing invitation to accompany us on a tour of inspection of any or all of our installations, severally or collectively, as may suit your convenience.

Paper by Philip W. Davis, Engineer

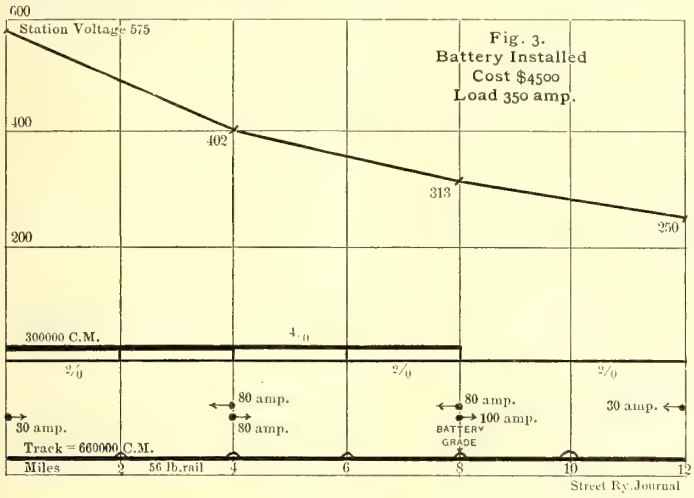
I have always found the street railway man of an inquiring turn of mind. Necessity has made him careful, and he does not always



confine himself to the question, "does it pay?" he is interested in knowing "why." It is this side of the question that Mr. Stone has bidden me pursue, and I will try to do it without being unpleasantly technical, but I trust you will excuse me if I introduce a few figures.

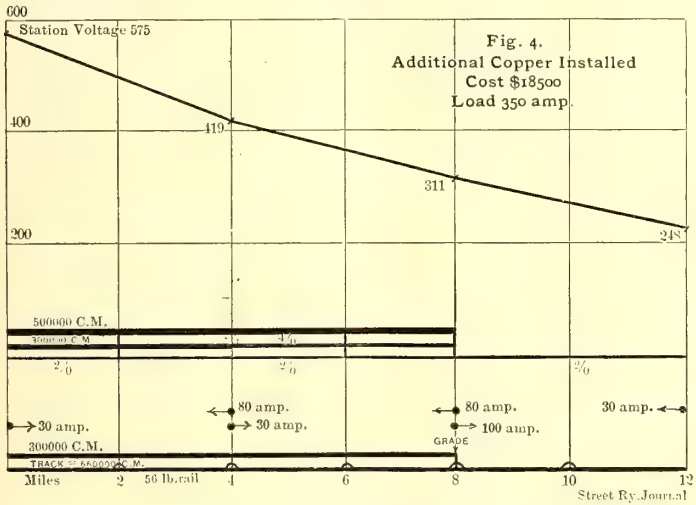
With a view of avoiding the want of exactness which usually accompanies a general statement, I have figured out the solution of a railway transmission problem by three different methods and have presented it in a graphical form so that the results may be easily compared. While this problem is a special case of a line battery, still I think it illustrates fairly well the value of a storage battery in all its phases. The diagrams represent at the bottom a single track with turnouts, marked by loops, 2 miles apart. It is supposed that 8 miles from the power station is a rather long and steep grade, reaching perhaps as high as 8 per cent. The track is 56-lb. rail, and is equivalent to about 660,000 circ. mils of copper. The line consists of a 00 trolley throughout, a 300,000 feeder running out from the station for 4 miles, and a 0000 continuing to the grade,

4 miles more. The cars are shown as dots, with arrows indicating their direction. The line voltage for the instant under consideration is indicated above the copper. The load with six cars operating is found to average about 180 amps., and to have fluctuations reaching to 350 amps., occasionally a little higher. The line voltage has been calculated for two instants, the instant of average load, as shown in Figs. 2, 5 and 7, and the instant of maximum load, shown in Figs. 1, 3, 4 and 6. The road originally was 10 miles long and operated five cars, and there were, of course, four turnouts, not counting those at the ends. The lowest voltage encountered on the line at the time of heavy pulls was 220 at the grade. It was just possible to operate. But when it becomes desirable to add the extra 2 miles shown in the diagrams to the road



and operate six cars, the lowest voltage on the line at the moment of maximum pull will become, as you see on Fig. 1, 13 volts at the end of the line and 76 volts at the grade. Evidently this situation needs help.

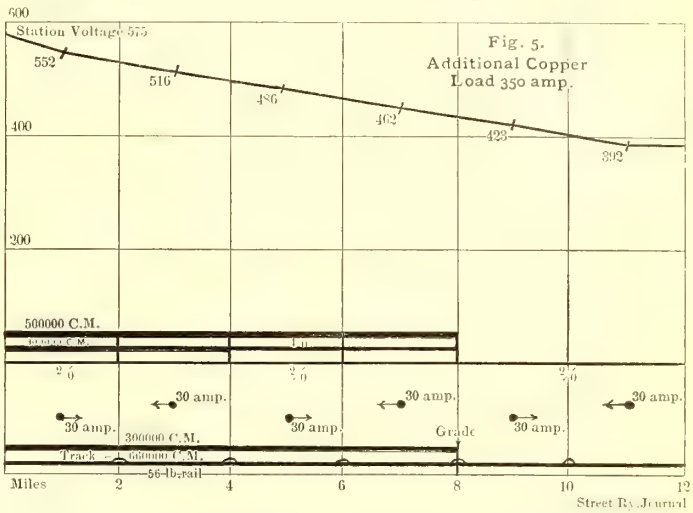
Now let us apply a battery to this road without in any way altering the copper. In the first place, where shall it be put? The heavy grade is a source of much of the trouble, it is there that the heaviest pulls come. In addition, at the foot of the grade is a car house. If the battery is put there it will be an easy matter to give it what little attendance it needs. The next step is to determine what voltage the battery must be capable of. The battery is to be operated as a regulator, alternately charging and discharging; its voltage then must be the same as the average voltage maintained at the battery location by the copper. If the volt-



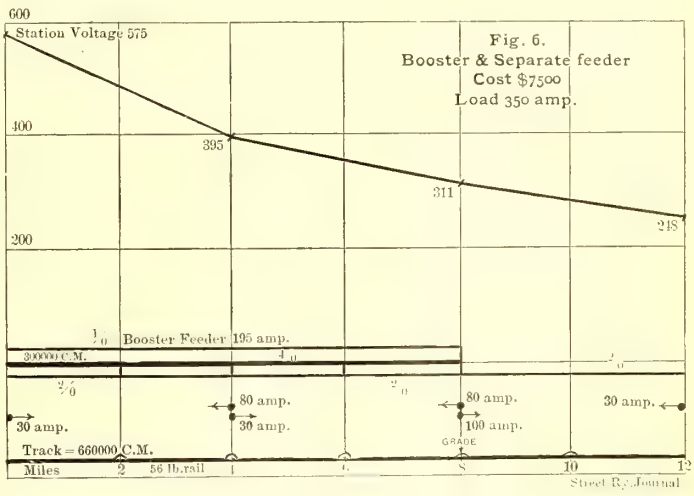
age of the battery were any higher it would discharge more than it charged, while if it were lower it would become overcharged. This voltage is about 340 volts, as shown by Fig. 2, and will require 163 cells. The next thing to be decided is the capacity of the battery. Evidently it must be large enough to take everything which the station cannot take. When discharging at its maximum rate the pressure at its terminals will fall about 27 volts, bringing the line voltage at the grade to 313 volts (see Fig. 2). This limits the drop between the station and the grade to 262 volts. With this drop the station can only supply 195 amps., and the battery then will be called upon for 125 amps. The nearest thing to this capacity is an E-13, rated at 120 amps., at the hour rate, and 163 cells of E-13 installed, with a switchboard mounting a circuit-breaker, an ammeter, a voltmeter and a switch, and making an allowance for the construction of a room or battery house, would cost about $4,500. In return for the investment the line voltage at the grade has been raised 237 volts, and is now sufficiently high to permit of very satisfactory operation of the road. In addition, the station has been relieved of 125 amps., or nearly 36 per cent of the load at the time of maximum pull.

Had copper been installed, as shown in diagrams Nos. 5 and 6, to give the same line voltage at the grade it would have required 8 miles of 500,000 feeder in the overhead line and 8 miles of 300,000 circ. mil feeder in the track, or over 102,000 lbs. of copper, which, at 17½ cents per pound, and allowing something for erection, would cost about $18,500, or about four times the cost of the battery.

We might, perhaps, use a booster and separate feeder to the



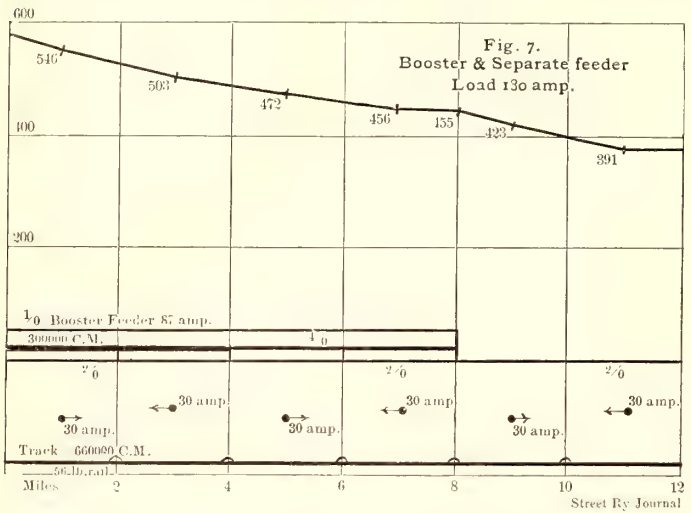
grade, as shown in diagrams Nos. 6 and 7. The less the investment in copper for this feeder the higher will be its resistance and the greater the voltage necessary to force current over it; therefore, the greater the cost of the booster. For the sake of avoiding the construction of special machinery it is also desirable to keep the voltage of the booster down to the limits of standard apparatus. A 0 wire and a 125-kw, 750-volt, motor-driven machine, series wound for 3.67 volts per ampere of load, is a combination that will give about the lowest first cost. The machine will cost about $5,000, and the copper, erected, about $2,500, making an investment of $7,500. Nor is this the end of the story: the ground drop is greater without the battery than it is with the battery, because, without the battery all the current to supply the demand must go out from the station and return to it at all times,



while with the battery, during the heavy pull, part of the current returns to the battery instead of to the station. As a result, the booster is called on to feed 195 amps. through the special feeder, while the existing copper only carries 125 amps. To force this load through 8 miles of 0 feeder requires 793 volts, of which 716 volts will be furnished by the booster, the remaining 77 volts being found as drop in the existing copper. This means an increase in the demand for power of 140 kw, being an increase of 70 per cent. If the booster has an efficiency of 65 per cent the demand on the generator will be increased from 70 per cent to over 100 per cent owing to the losses in the booster itself. It is evident then that the installation of a booster will more than double the maximum fluctuations and will add to the size of the machinery which must be in operation in the station, and also the coal bills. The extra power required does not maintain the same proportion at all loads,

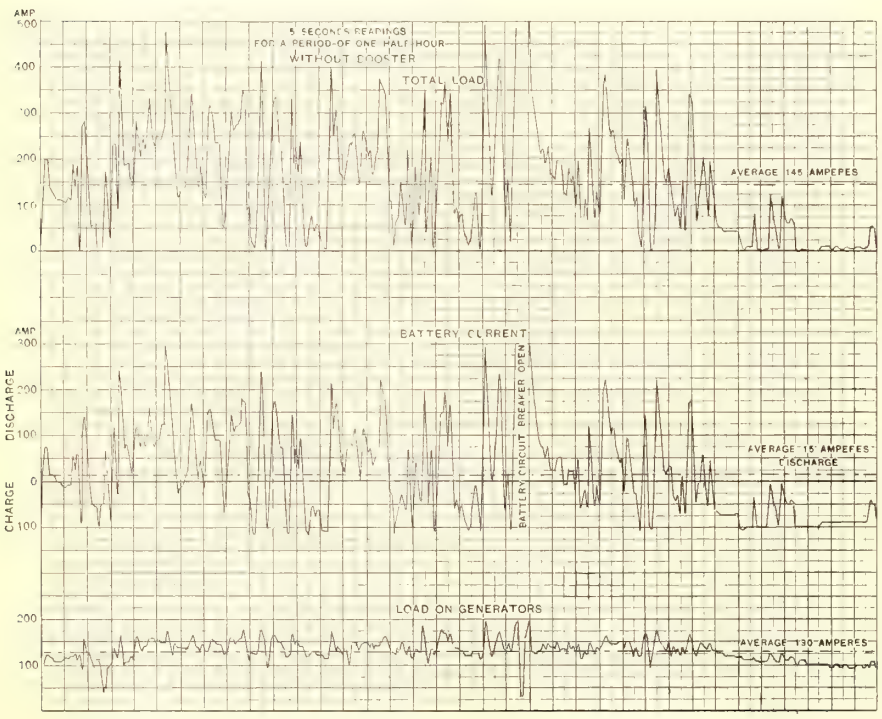
thus at average load 87 amps. at 319 volts, or allowing for the booster losses, 42 kw is the extra power demanded, and is an increase of 42 per cent.

In view of the losses back of the generator, and the decreased load factor for machinery operated, it is probably a conservative estimate to say that if this booster was installed the coal bill for the year would be increased between 50 per cent and 60 per cent. A station of this size would burn perhaps 2000 tons of coal per year, which, at $3.50 per ton, would be $7,000 per year, so that an increase in the coal of 55 per cent would mean an increased yearly



expenditure of $3,500. It is interesting to compare the operation of the station machinery under the two systems. The original station load averaging 103 kw, with fluctuations reaching 200 kw, could be operated with machinery of 150-kw capacity at a load factor of 69 per cent. With the battery the fluctuations come down to 130 kw, and the station could be operated with machinery of 100-kw capacity at a load factor of 100 per cent. The booster, on the other hand, brings the fluctuations up to 400 kw and requires the station machinery to be of at least 250-kw capacity, operating at an average load of about 140 kw, or 56 per cent load factor. The

Fig. 8



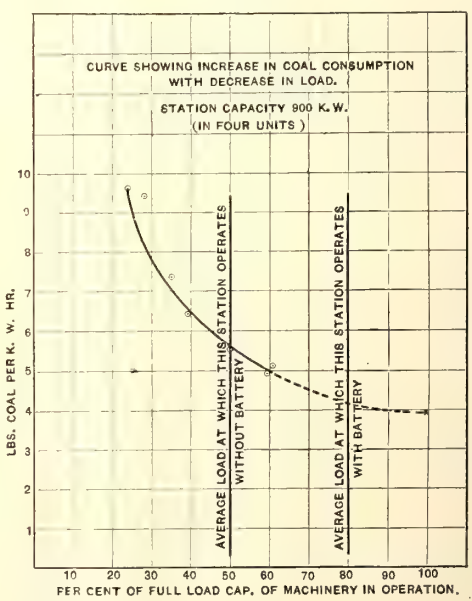
battery adds one other advantage not possessed by machinery, that of twenty-four-hour power on the line, for emergency work, lights for repairs, night operation, etc., and this without the operation of any machinery in the station.

When placed in the power station a battery cannot, of course, have any influence on the copper question, but it is then in the most favorable position to act as a regulator and maintain a steady load on the machinery which operates, thereby preventing the necessity of operating any more units than are just enough to take care of the average load. The electrical transportation of passengers by direct-current apparatus has long ago demonstrated its right to exist as an industry. It has passed the stage of a new enterprise and it has reached the point where future improvement will take the form of refinements in methods of operation. The storage battery offers the most inviting improvement in station operation that has come up since the beginning of the industry.

A glance at any diagram of a railway load is all that is needed to show the value of storage of power in a railway generating station. I have here a load curve (see Fig. 8) taken from a small railway where, as you see, without a battery it would be necessary to have in operation machinery capable of developing 290 kw or 500 amps. at 575 volts, which would be carrying an average load equivalent to only 75 kw, or 130 amps. A battery was installed in this station and the result is shown very clearly by the three curves indicating respectively line load, battery load and generator load. It will be interesting, I think, to lay before you in this connection the reasons that underlie the want of economy in an engine operated under light load. It proceeds from two causes—engine friction and cylinder condensation.

In the absence of exact data concerning the power required to overcome friction in an engine, 10 per cent of the rated capacity is a safe figure to assume. Thus, take the case of a 200-hp engine, it requires 20 hp to keep it moving; if it is running light or without load all the coal burned to produce the necessary 20 hp is wasted. If the load averages 20 hp half of the coal burned is wasted. If it be necessary to operate a 200-hp engine in order to care for a load averaging 60 hp on account of the fluctuations of the load it is necessary to burn sufficient coal to produce 80 hp; whereas, if it be possible to take care of this load with an engine whose full load is 60 hp the friction loss is only 6 hp, and it is only necessary to burn coal to produce 66 hp, a clear gain of 14 hp, or 17 per cent on friction reduction alone. The second factor, or cylinder condensation, proceeds from the property which steam has in common with all gases of cooling as it expands. As you all know, steam is admitted to the cylinder at boiler pressure for a portion of the stroke only. After that it is allowed to expand. If the engine were a simple, non-condensing engine the steam would enter the cylinder at perhaps 100 lbs. pressure, and expand down to 20 lbs. Steam at 100 lbs. pressure has a temperature of 328 degs., while steam at 20 lbs. has a temperature of 228 degs. It follows then that when steam at boiler pressure is admitted to a cylinder which has just exhausted steam at 20 lbs. pressure it finds the cylinder walls 100 degs. lower in temperature than itself. To the steam this is a good deal like going into an ice box, and so enough steam will instantly condense on the walls of the cylinder to bring their temperature up to that of boiler steam. On this account considerably more steam has to be supplied to the cylinder than that required simply

Fig. 9

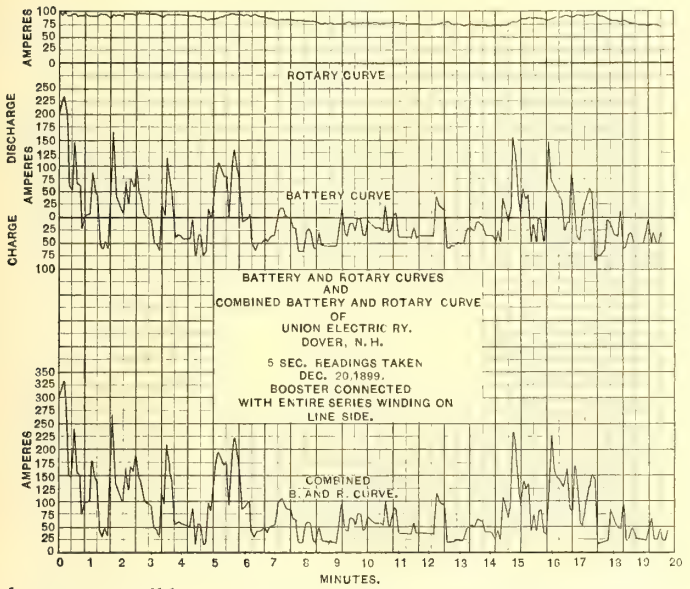

CURVE SHOWING INCREASE IN COAL CONSUMPTION
WITH DECREASE IN LOAD.
STATION CAPACITY 900 K.W.
(IN FOUR UNITS)
LBS. COAL PER K. W. HR.
AVERAGE LOAD AT WHICH THIS STATION OPERATES WITHOUT BATTERY
AVERAGE LOAD AT WHICH THIS STATION OPERATES WITH BATTERY
PER CENT OF FULL LOAD CAP. OF MACHINERY IN OPERATION.

to fill the space behind the piston. This condensed steam, of course, does no work, but requires just as much coal to produce it as if it did. Now, an engine working under light load cuts off earlier than under heavy load, and therefore its steam expands more, with the result that the cooling of the cylinder walls is carried further and more steam is condensed to warm them up. This action may be noted and measured by weighing the exhaust steam which comes from an engine, and comparing it with the quantity of steam called for from the indictor cards. The discrepancy is sometimes startling.

However, what interests you is how much these combined

effects enter into the cost of production of power in such plants as the average railway operates. Here is a curve (see Fig. 9) taken from the records of a power station containing four high-speed compound engines belted to four 225-kw generators. The loads on this station vary very widely on different days, and the curve represents the pounds of coal burned to produce a kw-hour of energy under conditions averaging from heavy load to light load on the machines that were operated. The curve shows that on certain days the machinery that operated did not average a load of more than 25 per cent, and that under such circumstances it took 9½ lbs. of coal to produce every kw-hour of energy. Of course these days were very infrequent. This station averages a load equal to about one-half the capacity of the machinery which is in operation, and its coal economy is 5½ lbs. per kw-hour. The type of machinery operated here is capable of doing 4 lbs. when operated steadily at full load. By the installation of a battery it

Fig. 10



becomes possible to average at least 80 per cent load factor and 4½ lbs. of coal per kw-hour, a clear saving of 1¼ lbs. of coal on 5½ lbs. for every kilowatt produced, or a reduction of 22¾ per cent in the coal bill.

A very interesting application of the storage battery is found in connection with the rotary converter and polyphase transmission for long-distance work. A road operating rotary sub-stations with batteries is in a position to obtain as much benefit from the batteries as if they were located in the station. The machinery, including the alternating-current line and the rotary converter, need only be designed for the average load, and can be operated at an approximately steady load. It is also a marked advantage to be able to start the rotary from the direct-current end with the aid of the battery. When a rotary is started from the alternating-current end it demands a very heavy current; this current is out of phase with the e. m. f., and does not represent as much energy as it would in direct-current work, but its heating capabilities are just as great, and there is not a little danger of burning out some of the apparatus. Sometimes in rotary plants, where the starting is to be done from the alternating-current end, a small induction motor is added to the rotary to be used in starting. This means an extra piece of apparatus and an increase in the investment which lies idle. The presence of a battery is also of value in preventing pumping between rotaries and their generators by preventing the fluctuations of load, which tend to start the action. Where other apparatus is operated from the line which feeds the rotary the battery has a value as a regulator, as it prevents the continual change of phase relations between current and e. m. f., accompanied by the production of wattless currents and the consequent useless heating and surging of the effective voltage, which would ensue if the fluctuations of the railway load were allowed to fall on the alternating-current line.

I do not wish to leave this subject without touching on the question of the booster for use with batteries as a voltage compensator. The operation of a storage battery, that is, its charge and discharge, cannot take place without a change of voltage at the terminals of the battery. When a battery is placed on the line there is always sufficient change in voltage to permit it to operate. In the station, however, this is not always the case. Sometimes it is desirable to have the bus-bar voltage maintained very steady, in which case a booster becomes a necessity. It is at all times a useful piece of apparatus, as it adds flexibility to the system by bringing the battery absolutely under control, so that a turn of the wrist enables the station attendant to force either charge or discharge independently of the conditions of voltage and load that may be present in the station at the time. While the booster is an expensive machine per kilowatt, its energy capacity is small. It may be capable of carrying 400 amps., and yet its capacity would not exceed 16 kw.

Owing to the change of voltage at the terminals of the battery, a small portion of the fluctuations will fall on the generators unless a booster is used. If it is really desirable to eliminate the entire fluctuation, a booster must be used. The first curve that I brought to your attention is an example of battery regulation without a booster.

Fig. 10 is an example of a rotary station with battery and booster where the load fluctuations are practically eliminated from the load of the rotary. Three curves taken from the plant of the Woonsocket Electric Machine & Power Company show what may be accomplished with a booster in the way of voltage regulation, the maximum variation being within 2 per cent, or 10 volts. On small roads, however, the booster is usually a needless refinement. There is no need of keeping the voltage at the bus-bars down to a variation of ten volts, a variation of 50 volts is often not too great to be tolerated. Moreover, it should be borne in mind that a small fluctuation in the generator load does not mean much change in the steam distribution in the engine, owing to the effect of the fly-wheel, and again, the fluctuation in watts or energy demand on the dynamo does not increase in proportion to the drops. Perhaps the strongest point in favor of a booster in a railway plant is the desire of the railway manager who decides to purchase a battery to see among other improvements a higher average voltage at his station bus-bars; accordingly he calls for a sufficient number of cells to equal the desired voltage. It happens sometimes that after the installation of the battery it is discovered that the generators are not able to maintain an average voltage equal to that of the battery, and the result is that it is impossible to keep the battery properly charged. If the voltage of the generators cannot be raised, the remedy is to cut out of circuit enough cells to bring the battery voltage down to a level with the generators. If the extra voltage is really desirable it can only be obtained by the addition of a booster to the plant.

DISCUSSION

A short discussion followed the reading of the papers. Mr. Davis was asked if the proportion of load due to friction was usually greater or less than 10 per cent. He replied that this varied from 6 per cent to 12 per cent, and was undoubtedly very much less in large machines than in small ones. Mr. Davis also stated, in answer to inquiry, that in the first case described in his paper no copper whatever had been added. He also explained that the battery was figured for the average potential at the point of installation, and to take care of the demand above the average.

Mr. Stone was asked to make a few remarks concerning the durability of the storage battery. He replied that the best evidence as to the durability of the battery was to be derived from the experience of the users of the same. In the case of the Woonsocket plant and in many others, among which might be mentioned the Union Traction Company, of Philadelphia, the wear and tear after a period of several years' service had been found to be practically nothing. In street railway regulating batteries especially, the wear and tear is found to be very slight indeed. This is due to the fact that the battery is rarely, if ever, totally discharged, and therefore the chemical action under the usual conditions of momentary charge and discharge is but very slight. On a visit of a prospective purchaser to the Woonsocket plant, Mr. Lincoln, the manager of the company, was asked, in Mr. Stone's presence, whether he would repeat the installation of the battery under the same circumstances as those under which their battery was first installed, and Mr. Lincoln replied that he certainly would.

E. C. Spring, of the Norfolk Western Street Railway, was asked by Mr. Bradford, the president, what he had to say in regard to the storage batteries in operation on his road. He then spoke as follows:

"While I did not come here to advertise the Electric Storage Battery Company, a little incident happened about a month ago, which will illustrate what the battery system does in our case. About one-half of our road is operated from a direct-current machine at the power station, and the other half from rotary converters at Westwood, on the triphase system. The engine that was running the direct-current machine at Medfield went to pieces, thus shutting down the direct-current end of the line. All that was operating then was the three-phase system from Medfield to Dedham. The belt in the power station gave way and the road was then shut down on either end. I called up the car house by

telephone, and told the foreman that both ends of the line were shut down, when, to my surprise, he replied that everything was all right there, and there must be some mistake, as the cars were running on regular schedule time. 'Go in and see if the rotaries are not shut down,' I answered. He did so, and found the rotaries running as usual. This simply shows that the battery was backing up on the rotaries, and running the road at the same time. We think a great deal of the battery. Its operation is perfect. It enables us to start the rotaries from the alternating current end, and is especially useful in night work."

President.—I think it advisable to take up the business of the evening. I understand that some members of the Massachusetts Street Railway Association favor us uniting with them. In the first place the ordinary street railway man is not eligible to membership in that association. The street railway companies are members of the association, and each company is entitled to appoint a representative in the following manner, which I think is correct. A company with a capital stock of $100,000 is entitled to one representative, $100,000 to $200,000 two representatives, and all over $200,000 three representatives. This association is composed of the higher officers of the different companies, and the ordinary superintendent as well as other practical street railway men would not feel at home at these meetings. Although we are at all times willing to carry out any suggestions which the street railway associations of New England may offer, we do feel that this club of ours will enable us all to meet and discuss the practical operations of the different roads.

The minutes of the formation of the club were read, as were also the by-laws and constitution of the club, and were referred to the next meeting of the club.

Mr. Whitaker, general manager of the Portland & Yarmouth Street Railway Company, Portland, Me.—I did not come here with the intention of speaking, but simply came to listen and get all the information I could. I think the idea of a club of this kind is desirable, and it is certainly a necessity for the benefit of all who have anything to do with the practical operation of a road. The variety of subjects that can come up for economical management is a fruitful source of interest to all superintendents and railways. I am an outsider practically, although it is my intention to join the club.

Mr. Pastell, electrical engineer of the Lynn & Boston Railroad Company.—I have been a member of the New England Railroad Club for some three years, and attended most of its meetings, and I think there were only two meetings that were of interest to a street railway man. I think this is an excellent scheme, and I would suggest that a special meeting be called for two weeks from to-night, Sept. 19, in order that the constitution and by-laws be accepted and sub-committees appointed, especially a committee on publication. Every street railway man will be interested in the papers read before this club, and there ought to be some means devised whereby those who are unable to attend may have an opportunity to read them.

Mr. Henderson, of the Newton Street Railway Company.—I think the papers read to-night should be published in some magazine, and I, for one, will certainly favor that something be done in that direction.

Secretary.—I think I am safe in saying that the Street Railway Journal would be very glad to publish in its weekly editions the proceedings and papers read before the club, but I have no assurance of it. I will write the publishers and see what they say. If they do not feel disposed to publish these papers I think the club ought to do it. The New England Railroad publishes a magazine every month containing the minutes of each meeting and the papers read, together with illustrations, and it has proved a success.

Mr. Granger, of the Boston Car Wheel Company, Boston.—I have been very much interested in the progress of the New England Street Railway Club, and have made it my business to talk to all my friends, not only those interested in the operation of street railways, but also in the supply business, and every time I have made mention of it the parties I have spoken to have been anxious to join. I have a list of friends who are, by the way, street railway men, who would like to become members, and have asked me to submit their names, and if the committee will accept them for membership, and send them their notice of being elected to membership they would be very glad to attend the meetings. Parties in New York and Boston would be glad to become members.

President.—I would suggest that Mr. Granger leave his list with the secretary, and the same will be taken up at the next meeting of the executive committee.

President.—I have been on a small road for some years, and it has been impossible for me to keep up with the larger roads, regarding new devices, etc., and I would like to know something about the rotary snow plow.

Mr. Spring, of the Norfolk, Western Street Railway Company.—I would suggest that the executive committee get someone to speak on the snow plow question at the next meeting, for the subject will be very interesting, especially to suburban lines, where they encounter considerable difficulty during the winter months in keeping the snow clear from the tracks.

(It was voted that the committee act on these suggestions.)

Voted: That a vote of thanks be tendered Messrs. Stone and Davis for their interesting papers.

Voted: That a vote of thanks be tendered to the Rand Avery Supply Company for the free use of its rooms for this meeting, and for the cigars which the members seemed to enjoy.

Mr. Henderson.—I think we ought to combine all our efforts to get a large number present at the next meeting of the club, which will be two weeks from to-night. I think if we make a strong effort we can get a very large crowd.

At this point the meeting adjourned.

Retirement of C. K. Durbin

After a long and successful term of service as superintendent of the Denver City Tramway Company, Denver, Col., Charles K. Durbin has resigned his position, and will engage in a private business enterprise. Mr. Durbin was held in the highest esteem by the company, and the directors with regret lose his services. His successor has not yet been appointed, and probably will not be named for several weeks. As a mark of regard, the company presented Mr. Durbin with a gold watch, suitably engraved, and adopted resolutions, given below, testifying to its appreciation of his work. The employees also presented Mr. Durbin with a handsome diamond ring and a set of link cuff buttons with diamond settings.

C. K. DURBIN

Mr. Durbin's connection with the company that has developed into the present Denver City Tramway Company commenced in June, 1888, when he was appointed auditor. In November of the following year he became superintendent. His term of service began when the development in street railway work had just started. The company was experimenting with the underground electric system on Fifteenth Street, and expended considerable money in endeavoring to make the system practicable. At the present time the system of the company covering the city of Denver is operated by the trolley. During the years of his superintendency Mr. Durbin has had experience with horses, steam dummies, the cable and electricity. During this same period the two most marked features of the company's system were introduced. First was the method of dispatching cars following the practice on steam railroads. This innovation has been adopted in Portland and Los Angeles, and has been found extremely serviceable in the operation of cars. The second feature was the method of paying the men. Each night the conductor pays the day's wages to the motorman and himself. This plan works admirably in practice. The office is required to handle a quarter less money; less work is required in the bookkeeping department, and the men like the arrangement far better.

Mr. Durbin has been successful in dealing with the employees in a marked degree. He has followed the policy of making the service lucrative and attractive to the men, so that they have been glad to hold their places. The schedule of wages was arranged with this idea in view. The first year the car men are paid 17½ cents per hour; the next two years, 20 cents; 21 cents the fourth and fifth years, and 22 cents after that. After five years' service the men have the right to wear one star on their coats, and after ten years they wear two stars. After ten years' service the employees are given uniforms by the company as presents. Last year ninety men received donations of this kind and 60 per cent of the present force have been in the company's employ more than five years. Mr. Durbin has had no trouble with the men, though he is a thorough believer in good discipline.

The resolutions which the board of directors adopted are as follows:

"Whereas, For upwards of fifteen years last past, Mr. Charles K. Durbin has been closely and prominently identified with the street railway enterprises in Denver, having served the Denver City Tramway Company and its predecessor companies during that period of time as superintendent, and

"Whereas, The untiring service rendered by Mr. Durbin has contributed materially to the upbuilding of the system of street railways in Denver in which we all justly take so much pride, and

"Whereas, Mr. Durbin is about to sever his official relationship with our company, for the purpose of entering upon private business; now, therefore, be it

"Resolved, That we, the board of directors of the Denver City Tramway Company, hereby express our deep appreciation of the earnest effort, absorbing interest and rare intelligence which have always characterized the official connection of Mr. Charles K. Durbin with our company, and

"Resolved, That his determination to withdraw from the position which he has so long and so capably occupied is a source of regret to each of us personally and as officers of the Denver City Tramway Company, and

"Resolved, That we hereby tender to Mr. Durbin our sincere thanks for the uniform courtesy, zeal and faithfulness displayed by him, in winter and summer, in storm and sunshine, during the hours of vicissitude as well as in prosperity, while acting as the superintendent of the Denver City Tramway Company and the companies which preceded it, and that we hereby extend to him the assurance of our best wishes for his future prosperity and happiness in whatever walk of life he may select, and

"Resolved, That a copy of these resolutions be presented to Mr. Durbin."

W. F. McCLELLAND, WILLIAM U. BYERS,
RODNEY CURTIS, WILLIAM G. EVANS,
G. E. ROSS-LEWIN, JAMES H. BLOOD,
S. M. PERRY, THOMAS KEELY,
GEORGE H. HOLT.

Annual and Quarterly Metropolitan Reports

The Metropolitan Street Railway Company, of New York, reports earnings as follows for quarter and the fiscal year ending June 30, 1900:

Quarter ending June 30	1899	1900
Gross receipts	$3,665,946	$3,849,354
Operating expenses	1,765,671	1,825,690
Earnings from operation	$1,900,275	$2,023,664
Receipts from other sources	77,768	79,245
Net income	$1,978,043	$2,102,909
Fixed charges	1,125,657	1,175,400
Net earnings	$852,386	$927,509

Year ending June 30	1899	1900
Gross receipts	$13,158,630	$14,721,550
Operating expenses	6,408,711	7,104,607
Earnings from operation	$6,749,919	$7,616,943
Receipts from other sources	366,893	351,985
Net income	$7,116,812	$7,968,928
Fixed charges	4,477,757	4,608,768
Net earnings	$2,639,055	$3,360,160
Dividends paid	2,471,675	3,145,891
Surplus	$167,380	$214,269

The balance sheet of June 30 shows:

ASSETS

Cost of road and equipment	$35,682,169
Stocks and bonds	21,644,457
Supplies on hand	103,778
New cons. on lines owned and leased to be distributed	18,068,359
Office furniture	18,304
Improvements, additions and betterments charged to leased lines	2,776,065
Bills receivable	271,886
Cash on hand	12,489,276
Open accounts	37,291
Total	$91,091,587

LIABILITIES

Capital stock, common	$44,960,900
Funded debt	21,750,000
Bills payable	8,756,736
Interest accrued	401,275
Dividends unpaid	786,815
Open accounts	374,280
Third Avenue R. R. Co. lessor construction account	11,419,834
Rentals and taxes accrued	621,830
Profit and loss surplus	2,019,915
Total	$91,091,587

PERSONAL MENTION

MR. BENJAMIN W. PORTER, formerly general manager of the Derby Street Railway Company, of Derby, Conn., was recently presented with a handsome set of Johnson's Encyclopedia in token of the esteem in which he is held by his former employees. There are eight volumes in the set, and they are bound in morocco.

MR. H. S. COOPER, whose resignation as general manager of the Ithaca Street Railway Company, of Ithaca, N. Y., was announced last month, has been engaged by a syndicate of capitalists as a street railway and operating expert. The plan is to undertake the reorganization or revamping of poorly paying roads, where there is a chance of improving their condition and placing them on a paying basis. The work will be carried on largely in the West and Middle West.

MR. L. B. STILLWELL has resigned as electrical director of the Niagara Falls Power Company, and will remove to New York City, where he will open an office as consulting electrical engineer. Mr. Stillwell has been connected with the Niagara Falls Power Company's electrical interests practically since their inception, the electrical machinery now in operation in the great 50,000-hp plant having been designed and constructed by the Westinghouse Electric & Manufacturing Company under his supervision while electrical engineer and assistant manager of that company, while as electrical director of the Niagara Falls Power Company he has directed the installation and operation of the plant since March, 1897. For the past two years Mr. Stillwell has given a large part of his attention to consulting work for other electrical enterprises, notably the equipment of the elevated railways of the Manhattan Railway Company in New York City, which is proceeding under his direction. Harold Winthrop Buck has been appointed electrical engineer for the Niagara Falls Power Company and its allied interests, including the Buffalo and Tonawanda companies, as successor to Mr. Stillwell. Mr. Buck is a graduate of the Sheffield Scientific School, and received his degree of electrical engineer from Columbia University. For the past five years he has held an important position on the engineering staff of the General Electric Company at Schenectady, N. Y. Philip P. Barton and Paul M. Lincoln, assistant superintendents, have been promoted, Mr. Barton having been appointed superintendent of the operating department of the Power Company, and Mr. Lincoln resident electrician.

L. B. STILLWELL

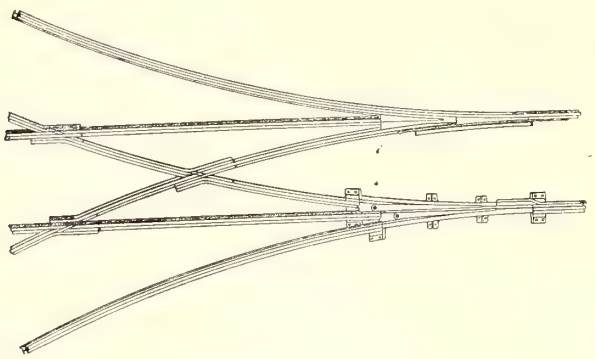
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

ELECTRIC RAILWAY PATENTS ISSUED SEPT. 4, 1900

657,099. Railway Switch; G. H. Fairchild, San Francisco, Cal. App. filed June 22, 1900. A double switch for three way tracks consisting of a main or straight track and right and left branch tracks leading therefrom at about the same point, with two inde-

pendent switch tongues, one in the outside rail of one branch, and the other in the inside rail of the other branch, each tongue having



PATENT NO. 657,099

a suitable and correspondingly located mate in the opposite sides of said branches.

657,123. Car Wheels; H. W. Libbey, Boston, Mass. App. filed July 27, 1899. The invention consists in forming the car wheel in two parts, the rear portion being formed with a number of recesses and having an elastic tread around its periphery. The elastic tread is formed with ears of projections that fit into the recesses in the rear portion of the wheel.

657,154. Sill for Underframe of Cars; W. P. Bettendorf, Davenport, Ia. App. filed March 15, 1899. The sill consits of two continuous beams (or equivalents) arranged one above the other and extending from end to end of the car, and above the car bolsters, the beams being separated between the bolsters to form a truss, then brought into direct contact and union at points above the bolsters and again separated beyond such bolsters.

657,180. Car Fender; R. F. Preusser, Washington, D. C. App. filed Nov. 20, 1899. Structural details on a combined fender and wheel guard, the fender being adapted to be folded back against the dashboard out of way of coupler when not in use.

657,198. Striker Arm for Car Seats; J. S. Johnston, Newport, N. Y. App. filed Jan. 20, 1900. Structural details which allow the back to be reversed in position and at the same time furnish stops which limit movement of the parts.

657,445. Anti-Friction Bearing for Car Trucks; J. A. Patten, Baltimore, Md. App. filed Jan. 19, 1900. Each ball lies in a separate socket so that they are maintained in proper working position. Portions of casing are made so as to readily wear away as balls and other parts wear, so that weight will always be on the balls.

657,480. Car Seat; T. B. Cann, Wakefield, Mass. App. filed April 25, 1900. Details which provide means whereby the reversal of the back causes also a reversal of the position of the foot-rest frame and seat.

657,481. Car Seat; T. B. Cann. Wakefield, Mass. App. filed April 15, 1900. Modification of preceding patent.

657,490. Car Seat; D. M. Houston, Wakefield, Mass. App. filed April 15, 1900. Modification of preceding patent.

657,492. Railroad Tie; E. A. W. Jeffries, Detroit, Mich. App. filed May 24, 1900. An elastic railroad tie. The body or main portion of the tie is formed of concrete or artificial stone.

NEWS NOTES

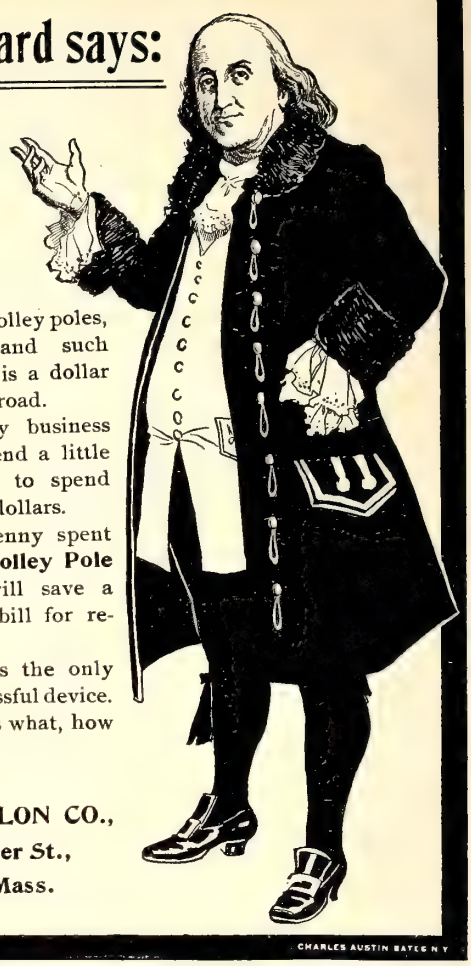
[*News notes for this department are solicited.*]

ATLANTA, GA.—Transfers are now granted from the lines of the Atlanta Railway Company, which run out McDaniel Street to McPherson Barracks and also out Cooper Street to Grant Park, to those of the Atlanta Railway & Power Company, of which the former company is a part. Transfers are given to all lines at the point of contact with the tracks of the Atlanta Railway Company.

JACKSON, GA.—A stock company headed by Capt. W. F. Smith, of Flovilla, has just purchased the Thomas shoals, on the Ocmulgee River. It is said that the deal is of considerable importance, and that the company intends utilizing all the power of these shoals and furnishing electricity in Jackson, Flovilla and Indian Springs. It is said that the company also contemplates changing the Flovilla & Indian Spring Railroad into an electric line and extending it to Jackson.

EAST ST. LOUIS, ILL.—The employees on the Day line and the Suburban line running between East St. Louis and Belleville and the local street railway lines in Belleville went on strike Sept, 5. No cars are running.

Poor Richard says:



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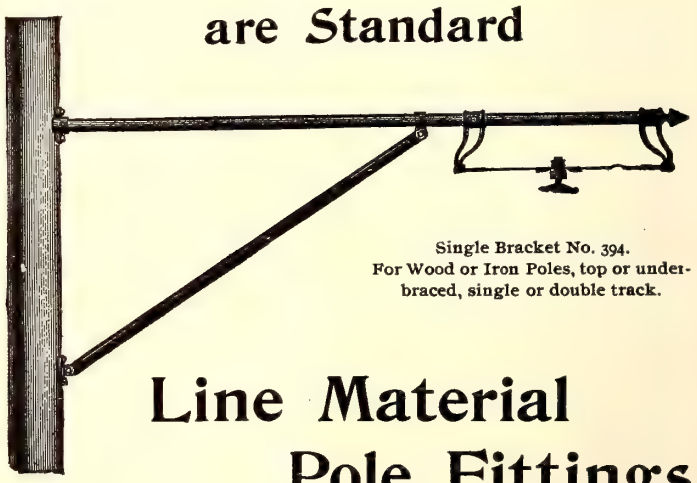

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STREET RAILWAY JOURNAL

WEEKLY NEWS ISSUE

SATURDAY, SEPTEMBER 22, 1900.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week in order to secure insertion in the current issue.

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A Visit to the New Manhattan Power Station

On Saturday, Sept. 15, the Brooklyn Engineers' Club had a pleasant outing in the form of an inspection tour to the Manhattan Railway Company's power house, which is now in course of construction at Seventy-Fourth Street and East River, New York. The excursion was enjoyed by about thirty members of the club, the engineers in charge of the work giving them every facility to inspect the details of the construction. The genial secretary of the club, A. J. Provost, Jr., succeeded admirably in preventing the visitors from missing any of the interesting features, and the club is to be congratulated for having so able a guiding spirit.

A Serious Collision Near New York

About forty persons were injured in a head-on collision between two cars of the Yonkers Railroad, of Yonkers, N. Y., on Sept. 15. The collision occurred on the Yonkers Avenue line, about half a mile east of the Empire City Trotting Track and at the foot of Valentine hill. Both cars were filled with passengers—one coming from the race track, the other going to the track. Car No. 215, the down car, left the race track for Yonkers at about ten minutes to 6 o'clock, and proceeded to the Kimball Avenue switch without incident. The next car to be passed was on the Napperhan and Yonkers Avenues switch, and after proceeding for some distance car No. 143 suddenly hove in sight. Power was reversed and the brakes applied, but too late. The cars came together with a crash. Both were derailed and completely wrecked.

New Air Cars for Twenty-Third Street, New York

Two of the new air cars of the Compressed Air Company, of New York, were placed in service on the Twenty-Third Street line of the Metropolitan Street Railway Company, of New York, on Sept. 15. The line extends across town from the East to the North rivers, and the first car started with a starting pressure of 1950 lbs. After making two round trips the car returned to the charging station with 950 lbs. remaining, showing that when the cars are fully down to their bearings and limbered up they can easily make additional trips with one charge of air. The second car also made two trips. Both are now running regularly. The air is furnished by a small compressor, as it is not intended to start up the large compressor until more than ten cars are in actual service on Twenty-Third Street. As soon as fifteen cars are in service they will be transferred to Twenty-Eighth and Twenty-Ninth Street line, and the entire service on that line will then be performed by air cars. The old cars, which were used on Twenty-Eighth and Twenty-Ninth Street line, aside from their other objections, were only able to make one trip across town, starting with a higher initial pressure than is used in the new cars.

The Chicago Tunnel Question

James B. Galloway has submitted plans to the Chicago Street Railway Commission for the construction of a set of seven single tunnels under the river to replace those now being used by the car lines. The city is now trying to force the companies to lower the present tunnels, and the companies have taken the matter to the Circuit Court, claiming that the city has no jurisdiction in the matter. The city claims that the present tunnels are an obstruction, but this is denied by the companies. It is estimated that new tunnels could be built by Mr. Galloway's plans at a cost of $1,500,000, and that they would obviate the necessity of lowering the present tunnels and would add to the efficiency of the street railway systems, while making La Salle Street a connecting link between the north and south side boulevards. It is advocated that the city build the tunnels. For the north side there are to be two tunnels for south-bound cars, in Wells and Clark streets, and one in Dearborn Street for north-bound cars, using Monroe Street, as now, for the southern boundary of the loop. The La Salle Street tunnel could be removed and a wide bascule bridge be placed over the river. It is further proposed that the street car tracks be taken up and the street made a boulevard from Jackson Boulevard to Lincoln Park. For the west side, east-bound tunnels would be in Van Buren and Madison streets, and west-bound tunnels in Adams and Washington streets; the temporary return of the Madison Street cars being through the Adams Street tunnel during the reconstruction of the old Washington Street tunnel. The places of approach would then provide outlets near the Union and Northwestern railway stations. The tunnels are to be 15 ft. in diameter, and are to be put 30 ft. below datum and with grades of 7.5 per cent, 8 per cent and 9.5 per cent.

The Convention of the New York Street Railway Association

The eighteenth annual meeting of the Street Railway Association of the State of New York was held at Buffalo on Tuesday and Wednesday, Sept. 18 and 19, with a large attendance. When the association was called to order by President Rogers at the Iroquois Hotel Tuesday morning, over one hundred delegates responded to the roll-call. Mayor Diehl welcomed the members of the association to Buffalo, after which President Rogers responded. He then delivered his annual address, which is given, in part, below:

PRESIDENT'S ADDRESS

Before the smaller cities and towns of our State can expect any very radical improvements in their street railway construction, or can render the service the public demands, the law requiring the street railways to pay for pavements must be amended. Much has been said and written upon this subject, and I believe that the public is aware of the unfair and unjust burden that is being placed on the small roads in these localities. It is the duty of the State of New York to rectify this serious error, which, in nearly every instance, means in the end a receiver, as has been illustrated throughout the State. The smaller cities try to impose the same burdens on street railways as do the larger cities upon their roads. What might not be a heavy burden to the one means destruction to the other. The suggestion has been made that each municipal body granting a franchise should be authorized by the statute to make a special contract with the applying corporation for either the construction or maintenance of pavements in the whole or different sections of the locality. The lack of elasticity in the present statute militates strongly against the best requirements of small cities for the joint interests of the roads and the public.

The Railroad Commissioners' report of 1899 shows that there are ninety-four electric roads in this State, and forty-one show a deficit while only fourteen declared a dividend. Of the latter, four were in the smaller cities, being operated partly as interurban roads. This report also shows a gain in the receipts of the surface roads over the previous year in this State of 7 1-10 per cent; also that the lines of greater New York carried 55 per cent of all the passengers in the State and their increase was 74 per cent of the total increase of the State.

It is a recognized fact that there is nothing that will more rapidly and permanently develop smaller cities than rapid transit, especially interurban service. Oftentimes the value of real estate in certain districts will advance upon the mention of an extension of a road in that direction. The people of provincial cities stand in their own light in not taking measures to have the above mentioned law changed. I am satisfied that the public is each year realizing more and more the benefits accruing from a well constructed, well equipped and carefully managed street railway in its midst.

The management of roads in the smaller cities make no mistake in taking the city authorities and the public into their confidence, appealing to their sense of justice and fairness. This course, if conscientiously and consistently followed, will result in much good. The sympathy and good-will of the people is necessary to the success of a street railway, and without it, especially in small cities, it is next to impossible to succeed.

The fate of the Ford franchise law, which was placed on the statute books two years ago, is yet to be determined. In my opinion there is but one result, and that is disappointment for the makers of the law, and the people, and dissatisfaction to the corporation which it affects. I would again call your attention to the injustice and unfairness of the law passed three years ago, taxing street surface railways 1 per cent on gross earnings, while other corporations (who are better able to pay the tax) are taxed ½ of 1 per cent. Nearly every legislator who has been consulted on the unfairness of this act admits that section 185 of the general tax law should be amended, thus leaving railway companies in the same situation as other public service corporations. It is our duty earnestly to take the matter up with the Legislature, and I believe that this serious injustice can be rectified.

Foreign street railways seem to be more fortunate than those of the United States in the matter of tax upon gross earnings. As an illustration—the British tramways are paying into the public treasury less than $600,000 annually in a formal tax on gross receipts of $25,000,000. The street railways of New York and Massachusetts alone are paying nearly $2,500,000 on gross receipts of $50,000,000.

The municipal ownership agitator is still active, but I think the fever has abated, at least it is working westward. No doubt some of these agitators are sincere and honest in their advocacy of the theory. If the craze is allowed to run its course, public opinion will in time desert it, especially after a few more illustrations of the impracticability of the theory in America under American politics. Under municipal ownership the agitator claims the wages of the men will be increased. Incidentally, perhaps, the vote of the political party then in power will also be strengthened as well as the taxpayers' bill of expense; this is a phase of the question which every American taxpayer should study. The majority of the voters are not taxpayers, hence their liberality with other people's money.

Municipalities should not be allowed to mortgage the unborn generations to produce the construction or operation of public service industries to satisfy the theorist. They should only be allowed to secure funds for such indebtedness by mortgaging the property income of the undertaking, and the franchises themselves and the mortgage should stand or fall upon such merits. Such a mortgage, of course, would be subject to foreclosure by default the same as a mortgage given by a private corporation and without recourse to the taxpayer.

If the general impracticability of the theory of municipal ownership did not condemn it, another fact would, and that is that a business made up of detail and involving such close care and attention, could not be looked after successfully or profitably by municipalities, particularly with the present incomplete system of municipal accounting.

The work that was inaugurated at our last convention at Ithaca, with the object of further promoting a spirit of loyalty and goodwill and of increasing the efficiency of employees, has resulted in much good. We should continue to educate our men in the duties they are to perform, treat them as men, and make them feel that by intelligent service and loyalty to the company they can better their position and gain promotion. This is important to the life and development of street railways. Our benefit associations are important factors in accomplishing this end. I understand that nearly every road in the State has its benefit association and that each has the hearty support of its respective road; in fact, this department is given quite as close attention as any other department connected with the service. The success of these associations is largely due to the intelligence of the employees who are operating our roads, the solid principles on which they are organized, and the opportunity it gives the management and the men to help one another. The many benefits derived from these organizations are a just inheritance, not a charity.

One-third of the invested wealth of the civilized nations is today invested in railways, and not an inconsiderable portion of that investment should be protected. It goes without saying that a perpetual or long-term franchise is better suited for investors than a short-term franchise, which can be annulled at will. Under a long-term franchise, better construction and improvements can be made which will inure to the comfort and convenience of the traveling public. In this State a large number of the roads have long term, and in some instances perpetual franchises, but on account of the heavy burdens imposed by taxation and the municipalities and State requirements, only a small portion of the roads are paying a dividend, and of these a large number are in Greater New York.

In financiering a street railway, as large a portion of the bonds and stocks as possible should be disposed of to local investors, thereby insuring a local co-operation and interest that cannot fail to redound to the benefit of all concerned. It is very important for street railways to have as large a number of local stockholders as possible, thereby creating a common interest with the citizens in our properties. We must be frank and open with investors, which will result in securing and retaining the confidence and increasing the holdings and the number of holders.

A recent decision of the Appellate Court of this State and the decision of the lower courts in other States to the effect that cars designed to carry freight only are permissible on street railways is a decided gain for the roads which elect to engage in the freight and express business, which is becoming a matter of more importance every day, especially to interurban roads. Some very important express companies, I understand, are now in existence, operating entirely on trolley roads. The advantages of these companies in part consist of their quick service and ability to take freight from the farmer's door and transfer it through the various streets of the cities at frequent intervals. Freight and express service on the trolley roads seems to meet a much needed public requirement.

Stimulated pleasure riding and the establishment of parks and entertainments have proved to be a move in the right direction, and nearly all the roads have institutions of this kind, particularly those who are not confronted with the problem of providing efficient means of transportation for the large number who desire to ride.

There is no question but that the transfer privilege (with which we have been too generous) is being abused. There is no law obliging the roads of the State, excepting those recently built, to give transfers. If the transfer system of large roads could be so arranged that transfers were given only at points of any conse-

quence and to the passengers traveling in one general direction, and if it could be arranged that passengers could not secure transfers returning in the same general direction from which they came, it might eliminate some of the abuse.

The important suggestion that has been made, that the points of issuance of transfers should be limited and designated by the Board of Railroad Commissioners, will commend itself to all operating men.

Street railways have not, in my opinion, anything to fear from the competition of the horseless carriage. This vehicle may be used for carriage and cab purposes to some extent. The "loco" or "auto" is still the fad, however. We hope that the many inventors now working on the various vapor motors for the "auto" may produce something that will prove practicable and economical for street railway operation.

Much has been accomplished in the standardization of our accounts which will work out untold benefit to the roads; besides strengthening our securities, it will give confidence to the public, and afford us material for comparison. Our track system is also working out its own standard.

It is to be hoped that we will soon reach a standard in a permanent type of mechanical power, and it will be no longer necessary to discard costly apparatus because improvements have displaced them. As to equipment and rolling stock, we do not seem to accomplish much in standardization, except on the larger roads. This result is due to a combination of circumstances which I will not attempt to enumerate. If we could standardize our equipment it would be a saving in many directions.

The distance from New York to Boston of 257 miles is covered by electric railways, excepting about 52 miles, which illustrates the fact that street railways will soon connect the larger cities as well as the smaller ones. A story of a trip by trolley between New York and Boston has been recently published which is very interesting, and suggests that even a broader field than heretofore will be found for the trolley road.

It would be an oversight if some allusion were not made at this time to the wonderful development of the street railways of the State during the past year, particularly in cities of the first class. As a matter of fact, the improvement of the street railway service of New York, Brooklyn and Buffalo during the past twelve months has been almost startling in its character, and is an object lesson in rapid transit for the country at large.

Since the meeting of last year, the situation in the City of New York has expanded and developed with giant strides. The Metropolitan Street Railway company has pushed with great vigor the completion of the very important power house at Ninety-Sixth Street and East River. This plant has been laid out with reference to the interests of the entire street railway situation in the city. Its boiler capacity is remarkable, while the operation of the nine enormous vertical compound engines, remarkable for their accuracy and delicacy of operation, is a continuously interesting and instructive study. The plant, which will be completed during the coming year, is of primary importance in being the first station in the city of New York constructed for the development and distribution of the alternating current and the use of sub-stations with rotary converters and transformers.

The city is on the eve of another important improvement, to wit: The substitution of the electric current on about 25 miles of road now operated by cable. This work, involving millions of dollars in street construction and new equipment, is being pressed to a speedy completion and will undoubtedly result in great benefit to the traveling public. The passing of the cable roads brings to our attention the short life of the system. In the early '90's it was considered the motive power of the age, but a decade has seen its extinction for the movement of cars in cities. While the character of cable service has been raised to a high degree of perfection, the lack of elasticity in the convenient operation of car lines has been the chief cause for its extinction. The greater advantages in methods of operation furnished by electrically-propelled cars, or self-contained motors, will always commend these latter forms of operation to the minds of operating men.

The proposition of operating short crosstown lines in New York City is still subject to investigation and research. The great cost of the underground electrical construction, with its attendant expenditures for the removal of pipes and other property not belonging to the railway company, precludes the use of this character of equipment upon such short lines. At the date of my last address, the use of compressed air as a motive power was in apparently practical operation. While the type of motor then in use has not proved altogether successful, the test which is now being carried on by use of the Hardie motor will undoubtedly meet the requirements demanded of it.

Among the more important developments of the present day is the operation of the Thirty-Fourth Street crosstown lines by storage battery. The complete equipment of that line by that form of motor, and its actual operation as a system and not as an experiment, will demonstrate finally the desirability of the use of batteries as motors. The preliminary operations, as I am advised, are altogether successful, and there seems little reason to doubt that the operation during the winter will demonstrate the perfection of the system. For many years but little attention has been given to the improvement of storage batteries for street car operation. The great extension, however, of the use of these motors for cab service and small delivery wagons in this city has proved the desirability and usefulness of the storage battery, and called attention to its adaptability for the operation of railway lines requiring the use of self-propelled cars.

With the extension of railway systems in the city of New York necessarily follows the greater increase in travel. For the last fiscal year the returns of the Metropolitan Company show that 452,761,158 passengers have availed themselves of the right to ride on the company's lines, of which 297,254,580 were cash passengers, with 155,506,578 transfer passengers. These returns show an increase over the preceding years of 61,000,000 passengers carried, of which 34,000,000 were cash passengers and 27,000,000 were transfers.

There is no better illustration of what a street railway system, properly conducted and operated, can do for a large city than is manifested by the Brooklyn Rapid Transit Company. They have acquired nearly all of the surface railways of the city and thoroughly re-equipped same. They control and operate all of the elevated railways of the city, the larger portion of which they have equipped with the third-rail electric system. They have also acquired and electrically equipped some steam railroads leading to Coney Island, all of which are operated in conjunction and under one management.

Owing to the liberal policy adopted by the surface railways of Brooklyn, the bridge fare has been dispensed with, as far as car riders are concerned. You can now take a car at the New York City Hall and go to almost any portion of Brooklyn for 5 cents. The excellent transportation facilities with which Brooklyn is provided have done much toward developing the numerous and rapidly growing suburban localities of that city.

The advancement and improvement of the excellent street railways of Buffalo and vicinity will undoubtedly be exhibited in a practical way by our host, the International Traction Company. I have no doubt you will all derive great pleasure from the general inspection of and the ride over the several lines which go to make up the splendid system for which the locality is so justly celebrated.

During the past year the record of this association has been one of progress and improvement. The fact that it is established on a sound basis is shown by our meetings which I am pleased to say are so generally attended by the street railway people of the State who are seriously studying the question of transportation and how they can improve its condition.

Papers were then read on "Accidents on Street Railways; Methods Employed in Handling Same and Preparing for Trial," by D. W. Patterson, of the legal department, Metropolitan Street Railway Company, New York; "How Can We Increase the Efficiency of Our Employees?" by E. G. Connette, vice-president and general manager of the Syracuse Rapid Transit Railway Company, of Syracuse; "Railway Power Transmission," by J. H. Armstrong, of the General Electric Company, Schenectady, and "The Use of Storage Batteries on Small Roads," by B. B. Nostrand, Jr., president of the Peekskill Electric Light and Power Company, of Peekskill. These papers are published elsewhere in this issue.

At the afternoon session papers were read by Superintendent Thomas Henning, of the Buffalo power house; Vice-President T. J. Nicholl, of the Rochester Railway Company, and Prof. Norris, of Cornell University. After the close of this session the delegates were taken to the Cold Spring power house of the Buffalo Railway Company. After thoroughly inspecting this plant they visited the Pan-American Exposition grounds at the special invitation of Director-General Buchanan. Much interest was expressed in the buildings for this important fair, which have now advanced quite far, and at the extent of the proposed exposition.

The annual banquet was held Tuesday evening at the Ellicott Club. There was an attendance of about 200. Mr. Rogers presided and Mr. Ely, president of the International Traction Company, was toastmaster. The gentlemen who occupied seats at the principal table were the Hon. W. Caryl Ely, H. H. Vreeland, the Hon. S. Fred Nixon, M. Nussbaum, P. F. Trainer, H. H. Littell, Alexander J. Porter, T. F. Thomson, the Hon. William I. Buchanan, W. B. Rankine, Herbert P. Bissell, the Hon. John G. Milburn, Charles J. Bissell, Henry A. Robinson, Bert Van Horne, Tracy Rogers, the Hon. Conrad Diehl, Henry M. Watson, Charles W. Wasson, James H. McGraw and Otis W. Cutler. The

speakers included Mayor Diehl, President Milburn and Director-General Buchanan, of the Pan-American Exposition; Charles Bissell, W. B. Rankine, Herbert B. Bissell, S. Fred Nixon and H. H. Vreeland.

A full report of the proceedings of the second day, the remaining papers and the discussions on the papers presented will be published next week. There were a number of exhibits, as follows:

EXHIBITORS AT THE CONVENTION

The Couch & Seeley Company, of Boston, made a very creditable exhibit, showing the iron box telephone and other telephonic apparatus manufactured by it for street railway service.

The G. P. Magann Air-Brake Company, of Detroit, had an equipment on one of the Main Street cars, which was in continual operation. It proved a most practical method of illustrating the air storage system of this company.

The National Carbon Company, of Cleveland, had on exhibition samples of its new process carbon brushes, also battery carbons and various carbon specialties.

The Central Brake Shoe Company, of Buffalo, N. Y., and Reading, Pa., showed samples of the well known Diamond S. brake shoes.

The Edison-Johnson Electrical Manufacturing Company, of New York, exhibited its new type of trolley hooks, which are guaranteed to keep the trolley from leaving the wire.

The Cutter Company, of Philadelphia, showed one of its popular I. T. E switches.

The Bierbaum & Merrick Metal Company, Buffalo, had on exhibition samples of the "Ideal" trolley wheel. This wheel is very novel in its construction, and seems to be all that its name implies. Judging from the repeated orders received the wheel is fast finding favor with street railway managers. The company also showed samples of car bearings made from Lumen bronze, another specialty of this company.

The R. Bliss Manufacturing Company, Pawtucket, R. I., showed a handsome model of its patent safety car gate.

The Speer Carbon Company, of St. Mary's, Pa., made quite a display of its well known carbon brushes.

The Morris Electric Company, New York, had an extensive exhibit of the goods manufactured by the company, and the specialties which it handles. It consisted of rail-bonds of all types and for all purposes, pneumatic rail-bond and wire-joint compressors, Monarch fare registers, National electric car heaters, the Potomac terra cotta conduit, etc.

The Keystone Electric Company, of Philadelphia, showed various types of its well known voltmeters and ammeters.

Chisholm & Moore, of Cleveland, had on exhibition various sections of the American Standard rail-joints, tie-plates, etc., and also a fine collection of India ink drawings of traveling cranes, chain hoists and other power house machinery made by this company.

The Atlas Railway Supply Company, Chicago, showed various samples of its joints for all types of rails, also a combined rail-brace and tie-plate.

The Gold Street Car Heating Company, New York, exhibited samples of the Gold improved electric heaters, panel pattern, for cars with longitudinal seats and standard pattern for cross-seated cars.

The Weber Rail-Joint Manufacturing Company, New York, showed handsome samples of the Weber rail-joint, as applied to both T and girder rail.

Harold P. Brown, New York, made a display of the Edison-Brown plastic bonds, showing the various types and applications of these bonds.

J. W. Gorman, Boston, showed a fine collection of large and handsome photographs, showing scenes in many of the beautiful street railway parks in New York and New England, most of which are embraced in his park circuit of attractions.

The Consolidated Car Heating Company, Albany, exhibited some of its various types of electric car heaters.

The Hale & Kilburn Manufacturing Company, Philadelphia, had samples of its cross-seats on exhibition.

The Compound Magnet Brake was shown and operated on one of the cars of the Buffalo Street Railway. The equipment was in charge of P. H. Alexander, of New York.

The H. W. Johns Company, New York, showed samples of the line material and other specialties manufactured by it.

Mayer & England, Philadelphia, exhibited several types of the "protected" rail-bond, and samples of some of the specialties made or handled by them.

Giles S. Allison, of New York, had on exhibition models of the new steel sectional pole for trolley-wire construction, known as the electric tripartite steel pole, and for which he is the general sales agent. Much interest was taken by the delegates in the models of these poles, and several trial orders were placed. A number of roads on which poles of this kind are installed were represented at the convention, and the expressions in favor of the pole were quite pronounced.

How Can We Increase the Efficiency of Employees?*

BY E. G. CONNETTE

It is obvious that the interest of the employer is in the most faithful, intelligent and willing workmanship; the problem is, what method shall we pursue to secure a high standard of efficient employees. With skilled and willing men we are better able to effect a satisfactory service and more economical operation and a successful management of the interests entrusted to our care.

We will, therefore, discuss the subject upon the hypothesis that to secure an increase in the efficiency of employees, that they must be kindly treated, their willing co-operation must be secured and methods adopted for their education in the service.

I.—KIND TREATMENT

The employer has not discharged his duty in paying a laborer; he owes him also courtesy and friendly respect as a man. Men are naturally susceptible of kind treatment; even the wild instincts of barbaric races have been subdued by the kindness, forbearance and Christian charity of our missionaries. A dog that is kindly treated will wag his tail and give his master a cheerful welcome, while the cur that is beaten and knocked about will snap and snarl and run off with his tail between his legs when his master approaches. All men have more or less pride, no matter what their position may be, and directing men in their work should be done in such a manner as not to humiliate them, but in such a way that they will obey orders cheerfully and manifest an interest which shows, that to obey orders is a pleasure as well as a duty. Sometimes foremen who are placed in charge of departments are incapable of properly directing the men under them, by being abusive, overbearing and humiliating, due in some cases to ignorance and incapacity, but generally by an abnormal case of "swelled head." Some men think that they can make their orders more effective if accompanied with profane language, but, in the opinion of the writer, this only tends to reduce the efficiency, as men who are abused, oppressed, or treated unkindly will resent it in one way or another—this is only natural. Men show their noble qualities—courage, fairness, generosity—to those who treat them well and expect their best. This is true of the horses and cattle, which do their best for the masters who treat them most kindly. Instructions or orders issued in a kind and courteous manner, at the same time with a firm and positive accent, that carries with it respect and loyalty, will attain a quicker and more cheerful obedience, and result in a more contented and satisfied condition of mind, and will induce an earnest desire to comply with the wishes of those in authority. The indulgence of a desire to treat employees kindly should not, however, extend to familiarity, as familiarity may breed contempt and a lack of respect of those in authority; and there should be no relaxation of discipline, but it should be administered with justice and right, always giving the accused the benefit of any doubt which may exist and a penalty fixed which is commensurate with the offense, but only after a full and thorough investigation. Decisions in haste, by those in authority, during spasms of wrath when a breach of discipline occurs, is liable to impress upon employees that "might makes right." Our vocabulary also should contain words of praise and encouragement as well as reproof. Reward of merit is also an incentive to increased efficiency in the service.

II.—CO-OPERATION

A Roman Emperor said: "We are made for co-operation like feet, like hands, like eyelids." It is not right to treat men like machines or as rivals, but we should work together in order to secure an orderly and prosperous state; this is essential to success in all large enterprises—hearty co-operation with both great and small, from the janitor to the manager. A co-operation of brains and brawn—brains to plan and brawn to execute—with that regard and esteem existing between the two that makes an irresistible foe to failure and insures success in every enterprise. A general may direct, but his success depends upon the fighting qualities of his soldiers and the execution of his orders. A hearty, cheerful co-operation between the men and the officers and between the various departments is a large factor in bringing a high state of efficiency among the men.

* Paper read before the New York State Street Railway Association Sept. 18, 1900.

III.—EDUCATION

When by kind and fair treatment the respect and confidence of the men have been secured to such an extent that there is a hearty and cheerful co-operation, the men are susceptible of being educated, and while all men are not born with the same number of talents, still with a state of good feeling existing, they are capable of absorbing instructions and becoming educated to the extent of their capacity; and when men are willing to learn and increase in knowledge, sometimes those who are not even gifted with ten talents become more proficient by reason of their willing disposition and diligent application than others who have a greater capacity, but from a lack of co-operation, kindly feeling and lack of interest, they are unwilling to improve the efficiency of their position. When men are in the proper state to be educated, every possible means should be provided to instruct them in their particular position; but the same method should be observed in giving instructions as is observed in any other method of education. Instructive paragraphs, issued either in bulletin form or printed, should be short, but comprehensive; no unnecessary words or large, incomprehensive phrases used where small words and simple phrases will answer the purpose.

By a concise and simple, yet comprehensive, system of instructions, carefully arranged and administered in digestive doses, it will increase the efficiency of men in their several vocations, and will result in better service, both to the company and to the public, and a more economical operation.

"Storage Battery—Its Use on Small Roads"*

BY B. B. VAN NOSTRAND

The application of storage batteries to the generating system of large electric roads has been described by many engineers in a variety of ways, so that an impression has been left upon many minds that it is only with these larger systems that the battery scheme is feasible. This idea is incorrect, and I think that the following description of the equipment and operation of the Peekskill Lighting & Railroad Company will bear me out in the statement. In the description of this road we shall see conditions that apply in a general way to most small lines.

This road was placed in operation in June, 1899, since which time it has been running without any interruption except momentary stops caused by the circuit breakers flying out. Beginning at the station of the New York Central Railroad, which is at the western edge of the town, near the Hudson River, the road proceeds in a practically straight line through the center of the town and on to Lake Mohegan—a total distance of 4¾ miles. The road is an exceptionally hilly one, in fact the fairly level portions are the exception, and are never more than 1600 ft. long. Beginning at the New York station terminus, the road, as far as grades are concerned, is about as follows: Starting into town, there is 1000 ft. of 7½ per cent grade—with a small portion (say 20 ft.), where it reaches 9 per cent. For a distance of about 4000 ft. beyond this, there is a gradual grade, varying from 5½ per cent to 2 per cent, terminated by 300 ft., of 5½ per cent to 7½ per cent. At the top of this is a short level, leading into a 2000-ft. 2 per cent incline, followed by 1600 ft., varying from 4¼ per cent to 8¾ per cent, which is in turn followed by 2009 ft. of 3¾ per cent up-grade. There is after this a depression, represented by 1400 ft. of down-grade, varying from 6.8 per cent to nothing, which, after passing into a short level, rises by 1400 ft. up-grade, with a maximum of 4.6 per cent, to another short level. Then follows another down-grade of about 1800 ft., varying between 8 per cent and 2 per cent. This is followed by 1600 ft. of level—terminated by 300 ft. of 8 per cent. After this is 1000 ft. of level, passing into a short down-grade of 6 per cent, 1300 ft. of level is after this, passing into 2000 ft. of 7½ per cent. The final portion to the end of the road is about 800 ft. level.

This entire line of single track, with four turnouts, 56-lb. T-rails are used throughout, these being laid in the usual manner.

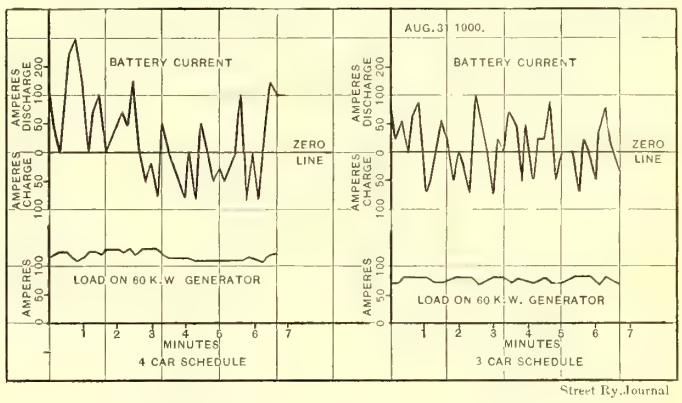
There is a single-track branch 4000 ft. long, extending from the New York Central station north to the State Camp Ferry. This operates but one month of the year, at which time two cars are in service.

The overhead construction of the system is simple—consisting of 00 trolley throughout, with 0000 feeder, extending to within ½ mile of the lake end and 1000 ft. from the station end. The branch has no feeder. The 0000 feeder is tapped at regular distances throughout its length.

The apparatus for operating the road consists of one 60-kw Edison bipolar 575-volt, 880-r. p. m. generator, belted to a horizontal 13-in. x 12-in. Armington & Sims simple engine, the horsepower of which is about 100, at 275 r. p. m. Belted to this same engine, in tandem with the dynamo, is a four-pole differential booster, which is used to render the charging and discharging of the battery automatic.

There is another unit consisting of a Westinghouse 120-kw multipolar 625-r. p. m. generator, belted to a vertical 14-in. and 24-in. x 14-in. Westinghouse compound engine of 200-hp capacity. It may be added here that this generator is rarely used, and that only when the road is unusually heavy—such as occur on holidays and warm Sunday afternoons. The same engine which operates this generator is also belted to one of the alternators for incandescent lighting. It may be well to note that in addition to the above engines there are three other engines which operate the remaining light machines. These, of course, have nothing to do with the railway system. In the boiler room are three 80-hp and 100-hp horizontal return tubular boilers, carrying steam at 105 lbs. pressure. During the summer months two of the 80-hp boilers are sufficient to run the entire plant—though three become necessary in winter.

The battery, which is in the simple wooden shed next the boiler



No. 1 No. 2

room, consists of 262 type-F-9 chloride accumulator cells. Each cell is comprised of nine plates, 10½ ins. square, suspended in glass jars of sufficient size to enable the capacity to be increased in future by the addition of more plates. Each cell is mounted upon a wooden tray, filled with sand, to ensure an even foundation for the jar. These trays rest in turn upon glass insulators, supported by a wooden battery rack. On full charge the battery has a maximum rated capacity of 160 amps. for short periods. As a matter of fact, however, it is often called upon to discharge at a considerably higher rate than this, 250 amps. being called for momentarily.

During the summer season three cars are run from 6 a. m. to 12 m. Two of these run through Peekskill as far as the car house at the eastern edge of the town. The other car runs through the town and on to Lake Mohegan. This gives a twelve-minute schedule in town, and forty-eight minutes through to the lake. In the afternoon and evening four cars are run, giving a twelve-minute schedule in town, and twenty-four minutes through to the lake. On holidays, etc., five cars are run, all going through—thus maintaining a twelve-minute schedule throughout the run.

Having gained a fair idea of the nature of the system, we will pass to the results obtained in the station.

The point of first importance is the remarkable constancy of the load upon the generator, and the correlated fact that the 60-kw machine is all that is necessary to operate the road, except when running the five-car schedule. The curve marked No. 1, in the engraving, will explain this. This shows the results of ten-second readings, taken upon the battery and generator during a short portion of a four-car run. The total line current is, of course, the summation of these two. It is seen that this total current fluctuates between 25 amps. and 310 amps., and that the generator runs along at practically full and constant load—the battery assuming the fluctuations above and below this. Curve No. 2 shows the same results for a three-car run. Here the average or generator load is lower (about 75 amps.), and the line fluctuations from 0 amps. to 170 amps. The practical good of this is evident. It means that a 60-kw machine is running instead of 180 kw, which would be required were the battery not in service. In other words, although the load fluctuates from almost nothing to 180 kw, the average is in the neighborhood of 60 kw, and it is this average only which falls upon the generator and engine. The remarkable evenness of the load upon the generator produced by the operation of a storage battery is shown very nicely by the fact that we are operating our 120-kw railway machine and one of the alternators for our electric lights from the same engine. Ordinarily this would produce a very serious flickering in the lights, but in our

* Paper read before the New York State Street Railway Association Sept. 18, 1900.

case it is impossible to detect the slightest change in the brilliancy of the lamps, although the railway may be fluctuating between its widest limits. I have not had an opportunity to test the coal saving produced by this arrangement, but I am confident from my observations that it is sufficient to pay a good return upon the battery investment over and above the interest and depreciation charges.

The increased economy of a small unit operating at a full and constant load above that of one three times the size, but doing the same work under highly fluctuating conditions, is such as to warrant this assumption.

It would be difficult to increase the simplicity of operation in this plant. After the original adjustment, the apparatus has worked together without the slightest difficulty. We have a generating unit operating under electric lighting conditions, due to the fact that the battery removes from the systems all sudden overloads, and the strain thus removed from the minds of those in charge is in its effect almost as valuable as this latter consideration.

In other ways the battery is valuable. A great many times it has been necessary to shut down the small engine suddenly from some mishap. During the eight or ten minutes necessary to get the other unit into operation the battery has carried the entire load.

Then, too, it is often desirable to run a car for some special occasion very late at night. At such times the generator is shut down and the battery thrown across the line.

In conclusion, I may state that the battery has given us absolutely no trouble since its installation, and the daily labor for its proper care does not average more than one-half hour. In fact about all the work required is that of taking voltmeter and hydrometer readings upon the individual cells once each week.

Accidents and the Methods Employed in Handling Them*

BY D. W. PATTERSON

It is an old saying that accidents will happen in the best regulated families; likewise is it true that accidents will happen on the best regulated street railways. It is not in the happening of accidents or the facts surrounding them that the real struggle in a negligence case takes place, and in this human nature is well depicted, and often much more care is taken in the preparation of the case from the standpoint of injuries than it is from the standpoint of proving how the accident happened, and many an attorney's dreams of large fees have been frustrated because of his zeal in proving the seriousness of the injuries and neglecting definite information as to how the accident occurred. It is interesting to notice the development of specialists in the law and in medicine, resulting from the possibilities of large fees from such a class of cases. A few illustrations may not be without interest: In one case a man received a slight injury in the location of his spine. There was little question but that the accident occurred in such a manner that the plaintiff was entitled to something for his injuries, but knowing that they were entitled to something they at once became grasping. They not only wanted enough to compensate the plaintiff for his injuries, but the lawyers evidently wanted enough out of it on which to retire. So they procured a large array of medical experts and engaged special counsel, and from the bruise was evolved the most fearful human afflictions. The plaintiff was carried into court, and after this pitiful exhibition his experts went on the stand and testified that he was suffering from amyotrophic lateral spinal sclerosis implicating the motor nuclei of the medulla oblongata. The defendant also produced its experts, and at the conclusion of the trial, which lasted for six days, the jury were so impressed with the falsity of the plaintiff's claim that they brought in a clear verdict in favor of the defendant.

It is such accidents as the one just referred to that are most dreaded by a defendant; where the injury is visible and definite; where an arm is broken or where a leg is amputated, no matter how serious the physical disability may be, there is less danger of large verdicts than where there is opportunity from a slight injury, or mere bruise, to build up a clever claim of a nervous disorder. Accident cases divide themselves logically into three classes:

First.—Where the plaintiff wilfully and systematically perpetrates a fraud.

Second.—Where the plaintiffs themselves are the sufferers of their own delusions.

Third.—The comparatively small number of cases where the nervous conditions claimed are real.

As an illustration of the first, I remember a case where a man had his arm injured, and his attorney asked him how high he could raise his arm, and he indicated a very marked impairment of its use. The defendant's lawyer, after diverting the plaintiff's mind from this subject for a few moments, suddenly said: "How high could you raise your arm before the accident?" and immediately the plaintiff, taken unawares, raised it high above his head. The defendant's attorney asked no other questions, and, amid the laughter of the court room and the amusement of the jurors, the discomfited plaintiff left the stand. In a similar case, a young girl was injured, and the trial not taking place until two or three years after the accident, she claimed that she had been bedridden during the whole time, that her health had been destroyed and that she was absolutely incapacitated from physical exercise of any kind. Nevertheless, upon the trial, while plaintiff was in the court room on a stretcher, the defendant showed a series of photographs in which the plaintiff was depicted hanging out clothes, rowing a boat, climbing mountains and performing other feats requiring physical strength and agility. After she had displayed her pitiful condition and her awful suffering, these photographs were shown to her one by one by the defendant's attorneys, and with flushed face she was compelled to admit that these were correct photographs taken of her since the accident, and that they correctly portrayed her in the acts depicted. These cases illustrate the first class, namely, where all the parties concerned in the plaintiff's case are attempting to perpetrate a gross fraud. It is this class of cases more than any other that test the ability to obtain justice and fair dealing, because with unscrupulous persons, fraud and simulation are so easy and the way of unearthing it so difficult that there is every inducement to cover up the tracks as much as possible, and experience has taught such persons that they are almost beyond the clutch of the criminal law, for while evidence may be procured which would satisfy any reasonable man that fraud and deceit has been committed, it is very difficult to fasten it upon a single individual for the purpose of securing a criminal conviction. But in railways, as in all great enterprises, it is the care which is taken with the apparently minor details which brings present success and gives assurance of future stability, and it is in this case for detail that such cases as these are ferreted out. So that from the moment of an accident until the time it is finally disposed of it receives the closest investigation and preparation.

The second class of cases, so far as the results before a jury are concerned, are as disastrous to defendant as though the injuries were real. They are known to the medical fraternity as cases of hysteria. They result from mental aberrations and not from physical injuries. Remarkable cases of this nature are not uncommon. There is a thoroughly authenticated case in which a person imagined that she was blind, although there was absolutely no defect in any functional part of the eye. Other cases are recorded of where a person thought he was dumb, and one of nervous temperament often imagines that he or she has paralysis or some kindred ailment, and until the mental condition again assumes its normal state for all practical purposes the patient is as helpless as though the injury or disease were real. But, the remarkable part about these cases is that oftentimes the imaginary affliction leaves instantly, as the result of a sudden shock or of intense feeling. But it is of little satisfaction to the defendant to find that after a verdict of $10,000, $15,000 or $20,000 for such imaginary ills that the plaintiff suddenly recovers.

When you consider that as there is all to win and nothing to lose in this class of litigation, it is not surprising with all the chances in favor of the individual and against the railway corporation, that a person who suffers real or imaginary injury from a railway accident very rarely fails to demand compensation from the company responsible, and if they are not responsible they are made so by the testimony of relatives or friends who "happened" in the neighborhood just in time to see it all. Mr. Lawrence Godkin, in Hamilton's System of Legal Medicine, states: "Probably half the jury cases in the courts of the State of New York alone in any one year are actions for personal injuries resulting from alleged negligence." This seems to be not only true, but, as everyone in the legal profession seems to be attracted to accident litigation at some time or other, it is increasing with alarming rapidity. For instance, during the year from October to June, 1895, the law department of the Metropolitan system tried about fifty cases in the county of New York. As against this it tried 233 cases involving $2,500,000 during the year ending June, 1900, and the claims presented for adjustment have increased proportionately. Again, in 1895, there were no more than 500 actions pending against the company, while at the present time (excluding the new Third Avenue acquisition and its leased lines) there are about 1929 litigants, demanding $16,000,000, awaiting

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trial. These figures indicate an increase entirely out of proportion to the number of accidents. What has done more than anything else to foster and increase accident litigation is the protection afforded attorneys by statutes in the enforcement and collection of contingent fees.

The attorney's fees in negligence cases are so large and the possibilities so great that there has been a systematic effort on the part of lawyers interested in this class of cases to procure legislation furthering their interests, and as this is a matter which has recently been before the Legislature and been defeated through our executive, it may not be amiss to refer to it here.

When a person is injured, no matter when, where or how, he is immediately deluged with pamphlets and cards and personal interviews by agents and runners termed in common parlance, "ambulance chasers," who solicit the injured person as a client for this, that or the other attorney. Oftentimes the first news a wife has of her husband's injury is from one of these lawyers coming to solicit her patronage and oftentimes the last person that a dying man gazes upon is the agent or runner of some of these lawyers. When one is successful in making an unfortunate victim of an accident his client, the agreement is at once presented, providing that the attorney shall get a percentage of the recovery together with all costs and disbursements and the percentage most usually inserted is 50 per cent. Long ago the influence of these attorneys was such as to secure legislation protecting such contracts and preventing the defendant from settling with the injured person without providing for the attorney also, but not satisfied with this, at the last session of the Legislature, a bill was passed which not only gave the attorney this lien upon his client's cause of action and which protected him against a settlement, but the new bill was directed toward absolutely prohibiting the party injured and the party causing the injury to settle their differences, and allowed the plaintiff's attorney, in case such settlement was made, to make a summary motion at Special Term and procure the same relief that he would have sought had the case been tried before a jury. As already said, the bill passed both Houses, but when it came to the Governor for signature, he withheld it and delivered the following memorandum:

"I withhold my signature from this bill because in my judgment it is thoroughly vicious. It provides that no settlement of any lawsuit shall be valid without the consent of the attorneys or without an application to the court upon notice to the attorneys. The code now provides all necessary security for an attorney in that it gives him a lien upon the cause of action. This bill would be of benefit chiefly to the very lawyers whom the honorable members of their profession least desire to see benefited—that is, to those who bring suits for damages on account of accidents and who wish to be in a position to mulct both their own clients and the defendants in case of a settlement. In its first draft the bill applied only to negligence suits. As it was passed, it applies to all suits. An unscrupulous attorney might turn it to his advantage by bringing a blackmailing suit at the eve of any great commercial or railway consolidation, when it would be in his power to hold up a settlement involving great sums of money. In short, the possibilities for fraud which are afforded by this bill are so numerous that it is not entitled to any consideration."

The unconscionable contract alluded to also specifies that the plaintiff is to bear all costs and disbursements. These two words have a very broad and comprehensive meaning when used by attorneys. Under it, the plaintiff's attorneys will place all expenses incurred in the preparation and trial, and as it is beneath him to itemize, why a lump sum is named, and as lawyers never have been noted for the correctness of their accounts, it may be confidently said that these disbursements are never underestimated. But the great inroad upon the plaintiff's 50 per cent of the recovery is made by his medical experts. These gentlemen are in such demand that they readily command from $150 to $250 a day, and oftentimes in the trial of a case they are required to attend parts of several days, and not infrequently to attend upon retrial of the action, and, as in the law, parts of days are never counted, so in estimating the bill for their services parts of days are ignored, and whenever called upon to appear the charge is for a day.

Is it to be wondered at that nearly every accident results in a law suit. Is it to be wondered at that to this branch of the law many are attracted whose only attributes are shrewdness and cunning. But more than this, leaving out of consideration the third parties, is it to be wondered at that the injured person is willing to accept a comparatively small amount in settlement, where such amount is paid to the person injured without any deduction for attorney's fees.

Adverting to expert testimony, mention should be made to the expert motorman. If he finds himself in the witness chair before a court room full of people there seems to be an irresistible tendency for him to attempt to show off, and this most often takes the form of claiming that he can stop a car in an incredibly short distance. It is a common occurrence if given the opportunity to testify, that he can stop a car within 5 ft. going 12 miles an hour. The highest appellate tribunal seems to have recognized the impossibility of this, for they have said that "This, upon its face, is untrue, for it takes one-half second to go 5 ft., a time not only manifestly insufficient to stop a car, but even to set the brake;" and here again the importance of having a motorman fully understand that by the question, within what distance can you stop your car, is meant not the distance a car goes after the brake is set, but means the distance the car goes from the time the object suddenly appears upon the track, and it is suggested that nothing can serve more profitably than for motormen to make practical experiments in stopping cars under similar circumstances to those under which they are called upon to testify. If this were done it would soon be appreciated that instead of stopping cars of many tons' weight within an incredibly short distance, that this distance might be doubled or even trebled, and if such experiments were conducted with sufficient frequency and publicity and made a matter of general notice, both the public from whom the jurors are drawn, and even judges who sit in review, would soon be in possession of undisputed facts, which would dispose of many cases which now serve as the means for furnishing a house for the client and a castle for the counsel. As a means of getting this matter before the public in such a way as to show its bona fide and reliability, it may be suggested that incentive be furnished to motormen by competitive prizes to be awarded for the best stopping.

It must have occurred to some that this subject of accidents has more to do with human nature than it has with the operation or management of street railways or with care or carelessness of the public. The number of actions brought to-day for personal injuries is out of all proportion to the number of actions brought in the recent past. It is not the result of a large percentage of injuries, but may be attributed largely, if not entirely, to the methods employed of appealing to human weaknesses and by arousing cupidity, throwing all else into the dim background. There is no remedy which can be suggested that is not too radical to be practiced.

The present condition is not due to chance or to the use of the term which served the subject of this paper "accident," it is the result of a system which is firmly established and is something which not cured must be endured.

Railway Power Transmission *

BY J. H. ARMSTRONG

In adopting 500 volts for railway service in the earlier days of the industry, it was thought that a sufficiently high potential had been chosen to make line losses a secondary consideration. The weight of cars and size of motors first used made it necessary to use much feeder copper in addition to the trolley wire, which, in most cases, had sufficient carrying capacity to move the cars at the extreme end of the road. The public were not very exacting in their requirements for rapid transit, and were satisfied with a service that would not be tolerated in our smallest systems of to-day.

The heavy cars, high schedule speeds and frequent stops of modern electric railway service have increased the car energy consumption to such an extent as to make the question of supplying a reasonably constant voltage over a large network one of the most important questions to be dealt with. Not only is this true of long-distant suburban roads extending 30 and 40 miles from the power house, but the large city systems have been so increased in extent by the consolidation of many small roads as to render almost inoperative the old system of 500-volt direct-current transmission from a single feeding point. The city system differs from its suburban offspring only in the more steady character of the station load, as the number of miles of track operated from a single generating station and the length of the longest feed in some of our large city systems is equal to or greater than any of our suburban roads now in operation.

The economical distribution of energy to the various units operating in a large railway system is, therefore, a question of as great importance and one to be treated along approximately the same lines in city service as in long-distant cross-country roads. This is especially true when we consider the advantages of locating a generating station in the outskirts of a large city where coal and water are available, facilities for removing ashes at hand, and

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real estate cheap, contrasted with the operation of one or more generating stations around which a growing city has spread itself, bringing up the fixed charges and operating expenses to a prohibitive limit.

In considering so large a question as the proper generation and distribution of power for railway service it will not be possible to enter into the many local details which will largely govern the system adopted in many cases, but various points common to all systems will be touched upon and some of the limitations of the various systems of operation brought out.

There are five recognized methods of distributing power which are applicable for railway work:

1.—500-volt direct-current distribution using the standard 500-volt to 600-volt direct-current railway apparatus.

2.—The operation of series-wound direct-current boosters in connection with 500-volt D. C. apparatus.

3.—The use of three-wire distribution using the track as a neutral.

4.—Alternating current distribution employing the use of alternating current generators of high potential, with step-down transformers and rotary converters suitably located.

5.—Alternating current generation and transmission with alternating current induction motors mounted upon the cars in place of the direct-current motors in the above four methods.

Excepting the last method of transmission—alternating current generation with induction motors—practically the same conditions govern the operation of large city and suburban roads. The design and operation of alternating current induction motors, however, depends entirely upon the character of the service which they are to perform, and their use will, therefore, be considered separately.

The first three methods of operation can be considered under the general head of:

DIRECT-CURRENT DISTRIBUTION

The advantages resulting from the concentration of generating apparatus in a single station have been demonstrated by the elimination of the various small generating stations when a number of small railway interests have been consolidated; operating expenses are reduced thereby partly on account of the reduced number of attendants required, less real estate carried on the books, and largely by the reduced coal consumption resulting from the more even load curve having small fluctuations.

In combining a number of 500-volt direct-current stations into one power house of their combined capacity, one of the most serious limitations of the direct-current system is immediately met with, that is, the limited area over which power can be transmitted economically with a reasonable amount of capital invested in feeder copper. If the generating station is located in the center of distribution of a closely congested district the copper investment will be comparatively small, but the price of real estate is high, and the location carries with it the probability of expensive water supply for condensing purposes and poor facilities for handling coal and ashes. The generating station also is likely to be hemmed in and little chance left for expansion, except at excessive cost of acquiring adjoining property. Hence although such a station operates at high efficiency as regards the transmission of power including interest on capital invested in copper, there are many fixed charges and operating expenses tending to bring up the total cost of generating power.

A generating station located in the heart of a city has to contend with the continual growth in the outskirts and the increased needs of heavier and more frequent car service, at what soon becomes a considerable distance from the center of distribution. It is also probable that parks and pleasure grounds will be located in the outskirts of the city at considerable distance from the power house, at which it is necessary to concentrate a large number of cars at very infrequent intervals.

The problem then becomes one of installing sufficient copper to take care of a service occurring but a few times during the year, during the remainder of which the copper investment is lying idle, or of installing series-wound boosters with a comparatively small booster feeder extending to the point of concentration of load. The booster in itself is expensive to operate, as it represents a dead loss of so many watts in the booster and feeder copper, but its operation for intermittent service of this character is fully warranted and preferable to the installation of a large amount of feeder copper carrying with it large interest charges, which are not warranted by the average traffic during the year.

The further increase in the growth of the town introduces new factors in the way of suburban connections which it is desirable to operate under the same management and from the same generating station as the city lines which feed them. The distance from a generating station centrally located for the congested traffic is, perhaps, so great as to necessitate a capital investment in feeder copper whose interest charge offsets the profits from operating such suburban connections. It is true that a direct-current generating station can be located somewhat outside the center of distribution of city load and in the direction of probable suburban extensions, but this entails a transmission of the main bulk of the load some distance to the center of distribution, resulting in a cost for power which, added to the interest on copper invested, may offset the advantages otherwise accruing to a suburban location.

Boosters may be installed for permanent operation, but, while it is true that local conditions largely govern the use of boosters, it can be generally stated that it is not economical to operate them on continuous service, while for intermittent service to help out a poorly coppered line on some special occasion they are valuable and might well be included in the apparatus of a central station.

The three-wire system has been mentioned as a possible means of power transmission for railway work, but only a general reference can be given to such a system owing to the delicate nature of balancing the two sides of the circuit, which is almost entirely a matter for local consideration. Such a system must necessarily require more care in laying out and more careful attention during operation than straight 500-volt distribution, but it may in certain cases afford sufficient advantages to warrant its adoption. In heavy work on private right of way where no objection exists to the use of two third rails, a balanced three-wire system may be used in which unbalancing is overcome, but the conditions demanding the adoption of such a system are entirely local and call for special consideration.

Most of our large city railways and practically all of our suburban roads operate their cars upon a recognized schedule, which is being adhered to more and more as the public becomes accustomed to a time table on electric roads. Where the headway is very short, say, two or three minutes or less, it is not necessary to refer to any time table, but most systems operate on a longer headway, and in such roads it is of the greatest importance that favorable conditions exist for the maintenance of a predetermined schedule. The 500-volt direct-current system fed from a single generating station centrally located affords full station potential in the congested districts where it is least needed, and minimum potential in the outskirts where the highest speed running is called for. If suburban connections are provided, the line voltage over an extended route will fall considerably from the bus-bar potential, and a schedule that can be maintained satisfactorily during normal operation becomes inoperative with such a system of distribution during hours of maximum service, owing to the considerably increased feeder drop at such periods. As the headway of cars is not so short as to interfere with the maintenance of schedule speed in the outskirts or on suburban lines, the copper investment becomes the determining factor in the maintenance of the schedule and the overload capacity of the system. Many of our suburban roads parallel steam roads and depend for their existence upon their ability to make as good time with more frequent stops as their steam competitor. The ability of the electric cars on such roads to make high schedule speed depends upon the maintenance of a good average line voltage over the entire route, while the frequency of service being perhaps one-half hour between trains is not sufficient to warrant the very great feeder copper investment that may be demanded by 500-volt direct-current distribution from a single generating station.

The necessity of re-enforcing the trolley voltage at intervals along an extended route has led to the development and adoption of the alternating-current system of distribution, which will be discussed under the general head of:

ALTERNATING-CURRENT SYSTEM OF DISTRIBUTION

The alternating system consists in brief of a generating station containing alternators generating polyphase current of several thousand volts, or generating currents of low voltage, which are stepped up to the required line potential, and transmitting this energy over a high-tension transmission line to sub-stations suitably located. These sub-stations contain step-down transformers and rotary converters, but may contain motor generator sets with an alternating motor wound for receiving the high-tension voltage direct without any intermediate transforming devices.

The system, therefore, possesses the advantages of being able to transmit energy over large areas at high voltage with a consequent small copper investment and small loss, while it can be transformed to direct current of 500 or 600 volts where most needed.

Owing to the large area which it is possible to feed from a single station, any local fluctuations of load are smoothed out and the generating station load curve can be made comparatively free from momentary fluctuations, thus resulting in high coal economy.

Where the length of the transmission line is comparatively small and potentials of not more than 10,000 or 12,000 volts are required for economical distribution, it is possible to wind the alternating current generators for the line voltage, thus dispensing with step-up transformers, but these become necessary where transmission potentials of 20,000 volts or more are necessary to keep line losses small with a reasonable investment in transmission copper, as it is expensive to wind generators for such high potentials. Step-down transformers must always be used in sub-stations where rotary converters are employed, as the voltage of the alternating side of the rotary converter bears a fixed ratio of about 64 per cent of the direct-current voltage, being thus approximately 350 volts for a 550-volt direct-current converter of the three-phase type. Motor generator sets may, however, receive line voltages up to 10,000 volts, but the saving of step-down transformers in this case is offset by the extra cost of the motor generator set over the rotary converter.

The alternating system has to contend with the loss incurred by transforming high-tension alternating current to 500 volts direct current, this loss being approximately 8 per cent at full load of converters and transformers. There is added to this a transmission line drop of 4 per cent or 5 per cent making the total drop from alternating-current generators to the direct-current bus-bars of the sub-station probably 12½ per cent at full load. In figuring upon the adoption of alternating current apparatus for railway work this loss of 12½ per cent must be taken into consideration and balanced against extra interest charges of copper investment and larger direct-current feeder drops of the straight direct-current system. To be more exact, the cost of the energy lost in feeder copper and transforming devices should be added to the cost of the sub-station attendance and interest charges on feeder copper for the alternating system, and compared directly with the cost of power lost in feeders and track, and interest on copper investment of the straight direct-current system.

The cost of maintaining a rotary-converter sub-station becomes a comparatively small factor in the operating expenses, due to the fact that a large part of this expense can be charged up to other accounts. In suburban roads the sub-station attendant combines with his other duties that of ticket seller, train despatcher, etc., duties which would demand the service of a man if a sub-station were not located at that point. In large city systems, where sub-stations are of considerable size, a certain amount of attendance is required, but this expense is small, as the duties of a sub-station attendant are very light.

The alternating system possesses the great advantage of being perfectly flexible and adapted for future growth or extension of the system. The possibility of locating sub-stations in newly opened districts and operating them from the main station with a small line loss and small copper investment, gives the alternating system a distinct lead over the straight 500-volt direct-current system with its limited sphere of action.

In a large city system it is possible to inter-connect the 500-volt feeder network so that during light night loads the outlying sub-stations can be shut down and the entire load thrown upon one or more centrally located stations, thus operating some of the sub-stations with perhaps one shift of attendants.

Modern suburban cars operating at speeds between 40 miles and 50 miles per hour, consume nearly 100-kw average for a 25-ton car, but demand two or three times this amount while starting or on severe grades. A direct-current generating station, supplying nothing but a suburban system operating upon half-hour headway, must sustain very violent fluctuations in load, resulting in a coal consumption in the vicinity of 6 lbs. per kw-hour, when the same engines would probably run on 3½ lbs. with a uniform load curve. The alternating current system, by combining the load of several isolated generating stations upon one set of engines, smooths out these violent fluctuations, thereby producing a load curve upon which engines and boilers will operate economically.

There are certain railway projects calling for intermittent running of very large units, demanding a large local consumption of power over an extended line. Trains may not follow each other at sufficiently frequent intervals to warrant the operation of rotary-converter sub-stations located at short distances apart, much less the installation of several isolated direct-current generating stations. Cheap water-power privileges may be in the vicinity of the line, offering an excellent reason for electrically equipping the system, provided the first cost of installation and labor expenses of operating can be kept reasonably low.

The alternating-current induction motor has been in commercial operation for several years, and is being manufactured in sizes of several hundred horse-power, starting with full-load torque or greater when used for such work as hoists, etc. The principles of its construction are well understood, and it can be accurately designed for the work it has to do. A train propelled by induction motors presents some characteristics which are novel from a direct-current motor standpoint.

The speed of the train is fixed not by the voltage of the trolley, as in the direct-current system, but by the frequency of the source of supply, which offers a much surer guarantee of maintaining a fixed schedule speed than the variable voltage supply of the direct-current system. The induction motor also has no commutator, and offers certain advantages in the way of a better dissipation of losses than the direct-current motor, so that its adoption upon long trunk lines presents many advantages.

The main benefit secured by using induction motors on long lines having infrequent travel is the low cost of installation and of operation due to the use of one or more generating stations feeding step-down transformers located along the line which do not require more than casual inspection. The main transmission line may operate at 10,000 volts or 20,000 volts or higher, depending upon the bulk of power and the distance to which it is to be transmitted, while the trolley or third-rail voltage being no longer confined by the limitations of the direct-current commutator can be raised to several thousand volts if necessary, and, in fact, is only limited by the quality of line insulation. By raising the trolley voltage to several thousand volts it will not be necessary to install expensive third-rail construction, as the currents carried will be small, and can be taken from overhead construction.

The location of step-down transformers along the line is determined by their relative cost and the cost of trolley and feeder copper between them. As they are used for intermittent service only while a train is passing, the step-down transformers can be made of small thermal capacity, but of large momentary overload capacity, so that their cost being small they can be placed comparatively close together, keeping line drops low and raising the efficiency of transmission.

The alternating-current induction motor system thus offers a system where schedule speed can be maintained without respect to line drop or grades, which feature particularly recommends it for the equipment of suburban and trunk lines having no city connections where it will be necessary to operate cars over city streets.

The alternating system requires polyphase motors to insure good starting torque, and to prevent loading up the lines with lagging or useless currents, and three wires being required it is undesirable to operate with a double trolley through crowded city streets. Suburban cars which pick up their passengers through the city have the advantage of providing a continuous passage from the heart of the city to the terminus of the road, while the induction motor suburban road would require a transfer station at the outskirts of the city.

The induction-motor system, therefore, appears best adapted for the operation of long suburban roads having no city connections, and especially those roads where heavy trains operate at infrequent intervals. By emphasizing this latter kind of road it is not intended to convey the impression that the induction-motor system is not equally well adapted for frequent service, but short headway is warranted only in crowded districts where the operation of rotary converter sub-stations would perhaps offer advantages in the distribution of 500-volt direct-current power for local railways.

RECAPITULATION

In the foregoing discussion the attempt has been made to bring out the fact that the electric railway field has become so broad and includes so many different problems in railway engineering that no one system of distribution is adapted for all classes of service. A small congested system, having its lines within easy reach of the power house, which enjoys good coal and water facilities is distinctly a 500-volt direct-current system, or if it has suburban lines where the service is intermittently severe the station should include a series-wound booster in its equipment.

Larger systems, either city or suburban, where the power generated is large and must be transmitted over considerable areas, present the dividing line between the 500-volt direct-current system and the alternating-current sub-station system of distribution. Local details enter into the problem in so large a degree in the consideration of such roads it is only possible to make the general statement that that system of distribution is the better in which operating expenses added to interest on copper investment and fixed charges figure out the lowest.

Suburban roads operating considerable lengths of track over which run heavy cars of 25 tons or 30 tons at speeds of 40 miles and 50 miles per hour can usually find in the alternating system a cheaper method of operation and a considerably cheaper first investment than will be the case if a number of comparatively small isolated direct-current stations were installed, or the attempt made to feed from a single direct-current generating station. The use of

boosters in such direct-current stations for permanent operation must prove expensive, and their operation will contrast unsatisfactorily with the service secured from rotary-converter substations fed from a single generating station well located.

The next class of service into which electricity has been entering in the last two or three years, the equipment of existing steam lines for suburban work and finally for trunk lines, calls for requirements which the alternating rotary-converter system cannot fulfil in many cases, owing to the infrequency of the trains. It may not be advisable in such roads to spilt up the large heavy trains into a number of smaller, more frequent units, especially if these large trains carry freight, owing to the increase in the labor expense account.

The alternating induction-motor system can operate heavy trains as a whole without increasing the large labor account by substation attendance, and can further guarantee the maintenance of a fixed speed over an extended line independent of line voltage and grades, and irrespective of the number of trains moved, a feature which is the basis of the operation of such long-distance roads. Where the service is more frequent, the dividing line between the induction-motor system and the rotary-converter system becomes less sharp, and local considerations may enter as the deciding factor in the adoption of one system or the other.

The system of distribution, like the railway motor itself, must be adapted for the work in hand, and, although the field of the three main systems overlap each other, there are certain fundamental characteristics of each which particularly adapt them for the operation of their own specific class of service.

Mr. Davis' Paper

Boston, Mass., Sept. 18, 1900.

Editors Street Railway Journal:

Dear Sirs.—I beg to call your attention to a typographical error in the paper which I read before the New England Street Railway Club on Sept. 15. Near the end of the paper I am made to say: "The fluctuation in watts, or energy, demand on the dynamo does not increase in proportion to the drops." What I did say was: "The demand on the dynamo does not increase in proportion to the amperes, because at the moment of the pull the generator voltage drops."

I also note that in the discussion Mr. Spring is quoted as saying: "The presence of the battery enables him to start the rotaries from the alternating current end." What he did say was: "The battery enables him to dispense with starting the rotaries from the alternating current end."

Philip W. Davis.

Train to the Kansas City Convention

The committee on transportation to the Kansas City Convention has issued the following circular:

CIRCULAR

The committee beg to advise that they have arranged with the Boston & Albany and New York Central & Hudson River Railroads for the accommodation of delegates and others, attending the above convention, as follows:

Leave Boston,	B. & A.	10.45 A. M.	Sunday, Oct. 14th.
" Worcester,	"	11.47 A. M.	" " "
" Springfield,	"	1.08 P. M.	" " "
Arrive Albany,	"	4.10 P. M.	" " "
Leave New York,	N. Y. C.	1.00 P. M.	" " "
" Poughkeepsie,	"	2.43 P. M.	" " "
Arrive Albany,	"	4.15 P. M.	" " "
Leave Albany,	N. Y. C.	4.30 P. M.	" " "
" Utica,	"	6.48 P. M.	" " "
" Syracuse,	"	8.15 P. M.	" " "
" Rochester,	"	10.05 P. M.	" " "
Arrive Buffalo,	"	11.55 P. M. (E. T.)	" "
Leave Buffalo,	L. S. M. S.	11.00 P. M. (C. T.)	" "
" Cleveland,	Big Four	3.35 P. M.	Monday, Oct. 15th.
" Indianapolis,	"	11.45 A. M.	" " "
Arrive St. Louis,	"	6.45 P. M.	" " "
Leave St. Louis,	Wabash,	10.15 P. M.	" " "
Arrive Kansas City,	"	7.00 A. M.	Tuesday, Oct. 16th.

The train will consist of Pullman vestibuled drawing room sleeping cars, and dining car, serving meals through to Kansas City. A special representative of the New York Central will accompany the party to Kansas City.

RATES OF FARE

Special rate of one and one-third fare on the certificate plan has been made, and delegates, when purchasing tickets, should ask ticket agent for certificate, which, on presentation at Kansas City, will secure one-third fare for the return trip. Sleeping cars at regular rates.

The committee in charge would respectfully urge that all who take the special train at New York, or stations on the New York Central & Hudson River Railroad Company, to communicate with Milton C. Roach, general Eastern passenger agent, New York Central & Hudson River Railroad, 1216 Broadway, New York, stating exact accommodations required, and from what point.

Fare from New York, one way, $31.75. Sleeper, one way, $7.50. Money can be remitted to Mr. Roach direct.

Those who will take the train at Boston and stations on the Boston & Albany Railroad should communicate with J. L. White, passenger agent, Boston & Albany Railroad, 366 Washington Street, Boston.

Reservations will be made in order as received, and prompt notification of assignment made to applicant.

The committee would respectfully suggest that delegates and their friends should make early arrangements. Applicants should address or call on ticket agent, Wabash Railroad, at Kansas City, for the return trip.

If the number will warrant, arrangements will be made for a special train from New York, Sunday morning about 10 o'clock, arriving at Kansas City Monday evening. The committee therefore earnestly requests all those who intend going to notify its members at once, so that, if possible, the necessary plans for the special may be made.

H. H. Vreeland, Chairman.
James H. McGraw,
T. C. Martin,
Charles W. Price,
Committee for New York.

Charles S. Clark,
Committee for Boston, 8 Oliver Street, Boston.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

STREET RAILWAY PATENTS ISSUED SEPT. 10, 1900.

657,622. Ice-Removing Mechanism for Railroads; J. J. Shirkey, Chicago, Ill. App. filed April 30, 1900. A series of spring supported wheels adapted to crush, grind and brush aside ice and sleet on third rails.

657,668. Automatic Railroad Frog; C. W. McKinney, Butte, Mont. App. filed July 5, 1900. Details of construction.

657,669. Air-Brake; J. J. Nef, New York, N. Y. App. filed June 22, 1898. Comprises automatic pump governing and controlling devices and friction clutch controlled by pump governer to throw the pump into and out of operation.

657,690. Switch Operating Apparatus; M. W. Brown, E. A. Byrne and J. Gilsenan, Newark, N. J. App. filed May 24, 1900. A box located between the rails underground contains a pivoted lever which is adapted to throw the switch tongue in either direction. A pair of links extend from this lever and connect with plates located at the surface of the ground. Pressing upon either of these plates to throw the switch may be exerted from a passing car through suitable levers carried by the car.

657,746. Body Bolsters for Railway Cars; E. W. Palmquist, St. Louis, Mo. App. filed June 4, 1900. A cast body bolster consisting of sides having horizontally extending flanges, a bottom provided with center and side bearings, and webs that tie the sides together at the top.

657,751. Rail-Joint; W. J. Whitaker and S. M. Gruber, Dravosberg, Pa. App. filed June 26, 1900. The rails are provided with extending tread portions so that when the ends of the rail abut a recess will be formed beneath the tread. A block of a contour similar to the web and base of rail is fitted in the recess, and the joint then mounted between fish-plates, which are formed integrally with the chair for supporting the base.

657,811. Rail-Joint; T. C. Clarke, New York, N. Y. App. filed Feb. 21, 1900. Comprises a pair of base plates upon which the rails rest, each plate having clamping lips for engaging the flanges of the rail and a girder formed by bending the outer portions of the plate downwardly, so that a transverse bolt may pass through such bent portions and secure the two plates. The bolt lies beneath the rail.

657,870. Railway Rail and Joint; S. Hazard, Cincinnati, Ohio. App. filed July 27, 1899. A railway rail of the T type, having an eccentric head reduced in depth upon one side and its flanges bearing proportionately projected upon the opposite or gage side of the head.

657,888. Joint for Railway Rails; J. F. Scullen, Chicago, Ill. App. filed Feb. 26, 1900. The abutting ends of the rails are beveled, forming an obtuse angled opening into which a correspondingly shaped section rail is fitted; the latter bridging the joint and being bolted to both.

PERSONAL MENTION

MR. J. S. SYMINGTON, president of the Sarina Street Railway Company, of Sarina, Ont., died suddenly a few days ago.

MR. A. N. CONNETT, of the J. G. White Company, Ltd., of London, and recently chief engineer of the French Thomson-Houston Company, of Paris, has been awarded a gold medal by the authorities of the Paris Exposition for the best exhibit on trolley construction.

MR. J. R. WHARTON, manager of the Butte Consolidated Railway Company, of Butte, Mont., was recently tendered a banquet by his employees as a tribute of esteem and a mark of respect. The banquet hall was gorgeously decorated for the occasion, and covers were laid for thirty-six guests. A most excellent repast was enjoyed, after which Mr. Wharton was presented with a gold watch, chain and charm by his employees.

MR. A. L. PARKER has recently been appointed second vice-president of the Detroit, Rochester, Romeo & Lake Orion Railway Company, of Detroit, Mich. Mr. Parker was formerly general secretary of the Y. M. C. A. at Detroit, and a year ago associated himself with John Winter, Oliver H. Law and Frank C. Andrews in their electric railway enterprises. They are the promoters of the Detroit, Rochester, Romeo & Lake Orion Railway, and the appointment is made in recognition of the valuable service rendered by Mr. Parker in the projection of different lines in which they are interested.

ENGINEERING SOCIETIES

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At a regular meeting of this society, held Sept. 19, L. C. Montony presented a paper entitled "The Ninety-Sixth Street Power Station of the Metropolitan Street Railway Company, of New York City."

NEWS NOTES

[*News notes for this department are solicited.*]

SAN FRANCISCO, CAL.—The Market Street Railway Athletic Club and Band gave an entertainment and dance at their new hall and clubroom at Valencia and Twenty-Eighth Streets on Aug. 31. An interesting prrogramme of musical and athletic events was presented.

NEW HAVEN, CONN.—The Winchester Avenue Railroad Company is considering the equipment of its closed cars with vestibules.

DENVER, COL.—It is stated that J. Brisben Walker, of Irvington, N. Y., has become interested in the Denver, Boulder & Northern Railway, and that the construction of the line is now assured.

WASHINGTON, D. C.—It is said that the officials of the Washington Traction & Electric Company are considering a plan for hauling farm products from the adjacent country. Large quantities of milk and vegetables can be brought into the city, and it is thought that this would prove quite profitable.

WASHINGTON, D. C.—The officers and employees of the Washington Traction & Electric Company are planning to form a relief association for the benefit of the 950 men employed by the company. President F. C. Stevens has promised to give $1,000 for the company as a nucleus for the fund. The monthly dues will be 50 cents or $1, and there will be an assessment of 10 cents on the death of any member. It is said that the establishment of a loan branch is contemplated.

CHICAGO, ILL.—A misplaced switch caused a car of the Calumet Electric Street Railway Company to jump the track at Stony Island Avenue and Seventy-Ninth Street a few days ago. The car ran into a ditch. Five passengers were badly shaken up, but were uninjured.

EAST ST. LOUIS, ILL.—Mayor Mathews, of Collinsville, has vetoed the ordinance granting the Mississippi Valley Railroad Company an extension of time for the completion of its line. The company applied for a charter a couple of years ago, and offered to build a line from the northern limits of East St. Louis along the Collinsville Road to the city of Collinsville, on the bluffs. Later the company applied for and was granted an extension in the matter of time for the completion of the line. The two years' extension was up a couple of months ago, and the company took another extension to Jan. 1, 1901. It was understood that the line could not be built by that time, and the company, by petition, applied for an extension of time at a recent meeting of the Council. The request was allowed after a fight in Council, but Mayor Mathews claims that the company has not kept its promise, and that he does not propose to let the road occupy the streets under the present ordinance, or even an extension of it.

CHICAGO, ILL.—The traffic report of the South Side Elevated Railroad Company for August shows that 1,908,267 persons were transported, as against 1,630,569 for August of 1899. The daily average for August, 1900, was 61,557, as against 52,599 for August, 1899. Below are given the traffic records so far this year, with comparison with those of last year:

	1899	1900
January	1,821,609	2,154,624
February	1,688,176	1,961,400
March	1,981,179	2,240,184
April	1,916,340	2,149,960
May	1,847,228	2,117,176
June	1,683,510	2,036,760
July	1,631,964	1,890,132
August	1,630,569	1,908,627

CHICAGO, ILL.—The traffic report of the Metropolitan Elevated Railroad Company shows that 2,432,167 passengers were transported in August, 1900, as against 2,110,170 for August, 1899. This year's traffic figures compare with those of last year as follows:

	1899	1900
January	2,242,490	2,756,135
February	2,109,632	2,593,304
March	2,456,533	2,929,748
April	2,323,920	2,712,900
May	2,352,590	2,674,928
June	2,172,990	2,466,180
July	2,093,338	2,287,490
August	2,110,170	2,432,167

BILOXI, LA.—Albert L. Covel, chief engineer and general manager of the Gulf Coast Electric Railway, is hopeful of beginning work on the new line in the near future. The road is to extend from Biloxi to Gulfport, with a branch to Handsboro.

DETROIT, MICH.—The People's Street Railway Company, a new line, is about to make application to the Council for a street railway franchise. Messrs. Stevenson, Merriam, Eldredge & Butzel are counsel for the company.

DETROIT, MICH.—There is talk of building a third electric railway from Detroit to Pontiac. Thomas W. Palmer is said to be behind the latest project.

DETROIT, MICH.—The Detroit, Rochester, Romeo & Lake Orion Railway Company has recently issued a beautiful brochure entitled "Scenics," descriptive of its line. It is printed on wood-cut paper, the reading being in red and the illustrations in green ink. The illustrations represent scenes along the line, and, from an artistic point, it is a fine specimen.

ST. LOUIS, MO.—The attorneys for the St. Louis Transit Company have filed a motion in the Supreme Court to quash the writ filed by the Attorney-General of the State to annul the transit franchise.

ST. LOUIS, MO.—The Suburban Railroad Company has applied to the Florissant Town Council for a franchise to extend its lines to the corner of St. Francis and Castelloe Avenues.

CAMDEN, N. J.—An ordinance granting the Camden & Suburban Railway Company a franchise for the construction of an electric railway through Riverton has been passed by the Riverton Council.

JERSEY CITY, N. J.—The North Jersey Street Railway Company will shortly make application to the Council of East Orange for a franchise for the construction of electric railway lines on Central and Springdale Avenues.

JERSEY CITY, N. J.—The North Jersey Street Railway Company and the Jersey City, Hoboken & Paterson Street Railway Company have completed arrangements with the postal authorities for transporting the mails between Jersey City, Hoboken, Bayonne and Union Hill.

CAMDEN, N. J.—The South Jersey Gas, Light & Traction Company, which recently completed a consolidation of Southern New Jersey gas, light and street railway companies, has elected officers as follows: Anthony R. Kuser, of Newark, president; William J. Bradley, of Camden, vice-president; Thomas N. McCarter, Jr., of Newark, treasurer. Directors: Uzal H. McCarter, Forrest F. Dryden, Chandler W. Riker, of Newark; Thomas A. Nevins, of East Orange; John L. Kuser, of Bordentown; William J. Thompson, of Gloucester; John J. Burleigh, of Camden; Herbert W. Johnson, of Merchantville; Charles Watson, of Camden; Barker Gummere, of Trenton; Frank Bergen, of Elizabeth; Thomas C. Barr, of Orange; Frank W. Montgomery and Maitland F. Griggs, of New York. The authorized capital stock of the company is $6,000,000, of which $3,389,000 has been issued. The company has authorized a mortgage in favor of the Fidelity Trust Company, of Newark, to secure an issue of $6,000,000 5 per cent gold bonds. Of this issue, however, only $3,160,000 are to be issued at present. The remainder will be held in the treasury for future needs. Among the companies included in the consolidation are: Camden Gas Light Company, Camden Gas & Fuel Company, Camden & Burlington Gas & Electric Company, Consumers' Gas Company, of Woodbury, East Side Gas Company, Gloucester Electric Company and the Camden, Gloucester & Woodbury Electric Railway Company.

PLAINFIELD, N. J.—A car of the Elizabeth & Westfield Street Railway jumped the track at the curve at the corner of Summit and South Avenues, a few days ago, and plunged 50 ft. across the street into a tree standing in the Central Railroad Station Park. The impact nearly split the car in two, and it was wrecked so that it will be impossible to repair it. The motorman, conductor and several passengers were injured.

AMSTERDAM, N. Y.—The Amsterdam & Hagaman Traction Company has made application to the Railroad Commissioners to construct its proposed electric line from Amsterdam to Rockton and Hagaman.

BUFFALO, N. Y.—The Buffalo, Niagara Falls & Rochester Railway Company has made application to the Town Board of Tonawanda for permission to construct and operate a street railway through the town.

BROOKLYN, N. Y.—A resolution to compel the Brooklyn Rapid Transit Company to put its trolley wires under ground was introduced at a meeting of the Board of Aldermen held Sept. 18. It was referred to the committee on railways.

BROOKLYN, N. Y.—Electric motor cars were run on the Lexington Avenue elevated line of the Brooklyn Rapid Transit during the rush hours for the first time on Sept. 5. The work of equipping the Broadway and Myrtle Avenue lines is progressing rapidly.

NEW YORK, N. Y.—The Manhattan Elevated Railway Company's escalator, now being put in by the Otis Company at Twenty-Third Street and Sixth Avenue, is unlike the moving incline plane at Fifty-Ninth Street and Third Avenue. This escalator is a moving stairway, or series of steps passing upward. A passenger may stand still on a step and be carried up, or if he desires to he may beat the stairs by walking constantly upward, as on an ordinary stairway.

NEW YORK, N. Y.—The Metropolitan Street Railway Company is now reconstructing its Park Row tracks opposite the Postoffice, so as to provide additional terminal facilities for the Fourth & Madison Avenue line, the Second Avenue line, and for a new branch of the Sixth & Amsterdam Avenue and the Eighth Avenue lines. The cars of the Sixth & Amsterdam and of the Eighth Avenue lines, which now have their terminal at Canal Street and Broadway, are to run through Canal Street to Centre, thence south to the Brooklyn Bridge and the Postoffice. The Metropolitan tracks and the Third Avenue tracks are to be connected with the Broadway line in front of the Postoffice.

LIMA, OHIO.—The employees of the Lima Railway Company are on strike.

AKRON, OHIO.—The Northern Ohio Traction Company has removed its general offices to a fine suite in the new Hamilton Building.

MANSFIELD, OHIO.—The Mansfield Railway Company has commenced work on a new car house on East Fourth Street.

CLEVELAND, OHIO.—The Northern Ohio Traction Company has made application to the Cuyahoga County Commissioners for permission to double track its road within the county limits. The entire road is to be double tracked.

MANSFIELD, OHIO.—It is stated that negotiations are under way for the sale of the franchise secured by T. Y. McCrary for an electric railway between Mansfield, Savannah and Wellington, to W. L. Elkins, of Philadelphia. Report has it that the terms will be $50,000 in cash and a block of stock in the road.

SPRINGFIELD, OHIO.—At the annual meeting of the stockholders of the Springfield Railway Company, held here a few days ago, officers were elected as follows: Oscar T. Martin, president; H. J. Crowley, vice-president; C. L. S. Tingley, secretary and treasurer; Oscar T. Martin, H. J. Crowley, C. L. S. Tingley, S. G. De Coursey, W. H. Shelmerdine, Silas W. Pettit, Theodore Troupe and John H. Miller, directors. A number of improvements will be made in the road, and Lansdowne Park will be opened up as a summer resort next spring.

TOLEDO, OHIO.—A misunderstanding of the new traffic arrangement between the Toledo, Bowling Green & Fremont Railway Company and the Maumee Valley Electric Railway Company, whereby the cars of the former are taken charge of at Perrysburg by employees of the latter and operated over a new belt line into the city, resulted in a collision between two Bowling Green cars on the first day the new arrangement went into effect. A dozen people were injured.

TOLEDO, OHIO.—The Toledo, Fremont & Norwalk Electric Railway carried over 5000 passengers Sunday, Sept. 9, which was the official opening of the road. The line will be in operation as far as Bellevue within two weeks, and to Norwalk by Nov. 15. Twenty-two cars are now in operation, and it is stated that a number of baggage-express cars are to be ordered in the near future.

COLUMBUS, OHIO.—The Columbus Railway Company has made application for a new twenty-five-year blanket franchise covering all the streets in the city now operated upon by the Columbus Railway Company, together with a franchise on South Parsons Avenue and on West Goodale Street. The ordinance provides that the city shall receive $7,500 annually and a percentage on the gross earnings to be agreed upon later. Besides the extensions desired, the ordinance provides for the connection of the company's lines at several points on High Street and grants the same fares now in vogue, with transfers on all cash fares of 5 cents. A section provides that as rapidly as the requirements of the plant and the service demand during the life of the grant, it shall expend not less than $750,000 in extensions, equipments and betterments. Another section provides that the company shall keep on deposit with the city at all times the sum of $1,000 as an emergency fund, against which the city may draw for the cost and expense of any repairs made by the city which, by the terms of the ordinance, should have been made by the company and which the company has neglected to do.

COLUMBUS, OHIO.—The Columbus, London & Springfield Electric Railway Company is making arrangements for the lease of a building to be used as a temporary power house. A permanent building will be erected at London. The three-phase system of distribution will be used, and a single power house will furnish current for the entire road.

HAMILTON, OHIO.—The annual meeting of the stockholders of the Southern Ohio Traction Company was held here last week. Directors were elected as follows: M. J. Mandelbaum, Jacob Mandelbaum, Will Christy, James D. Christy, A. E. Aikins, D. H. Kimberly, E. G. Tillottson, J. R. Nutt, Peter Schwab, G. A. Rentschler, F. T. Pomeroy and J. Lemprecht. Officers: Will Christy, president; M. J. Mandelbaum, first vice-president; Peter Schwab, second vice-president; F. Pomeroy, secretary and treasurer; Will Christy and M. J. Mandelbaum, executive committee. Reports of the treasurer showed the road to be in very prosperous condition. The question of improved service between Dayton and College Hill was decided upon, and will be adopted at once. The running time between the two towns will be reduced to three hours. The construction of new lines was discussed at the meeting.

READING, PA.—At the annual meeting of the Pottstown, Bayerstown & Reading Railway Company the following officers were elected: E. C. Watson, president; B. J. Woodward, vice-president; James M. Crawford, secretary; directors, E. E. Watson, B. J. Woodward, J. M. Crawford, of Philadelphia; M. G. Taylor, F. P. Esterly, of Reading. The company has a charter to construct an electric railway from Reading to Bayerstown, 18 miles, and thence to Pottstown, 8 miles.

BEAVER, PA.—At a special meeting of the directors of the Beaver Valley Traction Company held a few days ago, most of the members of the old board tendered their resignation and their positions were filled by the Philadelphia capitalists, who recently purchased the road. New officers have been elected as follows: Frederick Snyder, of Philadelphia, president; Walter Bilyeu, of Philadelphia, treasurer. W. P. McConnell will retain his present position as secretary. At the meeting large measures were taken for the building of the additional lines. The work of constructing the line to Monaco will be begun as soon as franchises are signed.

CLARKSVILLE, TENN.—The coupon ticket system has been adopted by the Clarksville Street Railway Company. The coupon books are used in four forms. One contains six green tickets, which sell for 25 cents; another, containing twenty-four white tickets, sells for $1, each ticket good for one fare; another, containing twenty red tickets, sells for 50 cents, each ticket good for one fare for children twelve years of age or under, and another containing yellow tickets, which is issued to those who have passes. In this way a complete record can be kept of the exact number of passengers hauled each day. The company will allow a discount of 5 per cent on all sales amounting to $5, and 10 per cent discount on sales amounting to $10 or more.

SALT LAKE CITY, UTAH.—The construction of the proposed Salt Lake Valley Electric Railroad between Salt Lake and Ogden has been abandoned, for the present at least. The company was not prepared to begin work when the franchise stipulated, and the franchise has lapsed.

NORFOLK, VA.—There is talk here of passing a law to compel the street railway companies operating here to carry school children for 3 cents.

WHEELING, W. VA.—The Northern Ohio Electric Company, which is to build an electric railway from Wheeling to Wellsburg, has organized permanently. Howard Hazeltt has been elected president; John G. Welty, vice-president, and John Arbenz, secretary and treasurer. The company has already secured the right of way and has ample financial backing. The road will be 15 miles in length and will traverse a fine agricultural country.

MILWAUKEE, WIS.—The Council has passed, over the Mayor's veto, resolution to enter into a five-year contract with the Milwaukee Electric Railway & Light Company.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has had a street sprinkler built at its Kinnickinnic Avenue shops. The sprinkler will be used experimentally on the National Avenue line. It was built for special occasions only.

TWO RIVERS, WIS.—The petition presented by T. Higgins, of Neenah, for a franchise here calls for a fifty-year grant and right of way over some of the principal streets here, traversing the entire city. The promoters agree to have the line in operation within two years.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company is now receiving bids for an addition to the boiler room of the River Street power house of the company, a distance of 140 ft. along the river front. The addition will be uniform with the new power house and will make the frontage 240 ft. on the river. The new boiler house will occupy about one-third of the depth between River Street and the river. It is estimated that the building will cost $100,000. The old boiler house will be torn down and work commenced upon the new one just as soon as the contract for the new one has been awarded.

MANITOWOC, WIS.—The City Council is being flooded with petitions for street car franchises. Those asking the new franchises are all local men except two, and are Judge Craite, John Murphy, Henry Schmidt, Thos. Torrison, W. H. Walker, of Milwaukee, and J. M. Seamann, of Sheboygan. They want a thirty-five-year franchise and promise to construct an interurban line to Two Rivers. The terms of this franchise are very similar to those now before the Council. A committe has been appointed to examine both.

CANADIAN NOTE

NIAGARA FALLS, ONT.—The Niagara, St. Catherines & Toronto Electric Railway Company has been granted permission to cross the upper arch bridge into this city. It is now possible for a person to take a car in Buffalo and with one or more transfers ride direct to Toronto.

STREET RAILWAY JOURNAL

WEEKLY NEWS ISSUE

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week in order to secure insertion in the current issue.

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THE CONVENTION OF THE NEW YORK STATE STREET RAILWAY ASSOCIATION

The convention of the New York State Street Railway Association, held in Buffalo, Sept. 18 and 19, was the most successful convention in the history of the association. This is saying a great deal, for the association has always been a vigorous one, and particularly during the last four or five years, under the presidency of G. Tracy Rogers, has enjoyed a most healthy growth. This has been shown not only by the increased attendance at the conventions and the greater value and interest of the papers presented at the meetings, but also by the increased support given to it by street railway companies in the State, and by the important and influential work which it has carried on for the benefit of the industry in general. The re-election of President Rogers and Secretary Robinson was a well-deserved recognition of the faithful services of these officials, while the executive committee, consisting of Messrs. Vreeland, Ely, Nicholl and Rossiter, have been untiring in their efforts to promote the best interests of the association, and through it all the street railways of the State. The future outlook for the association is most bright and promising. The street railways of the whole State, both large and small, are working harmoniously for the common end, *i. e.*, to make the association a power in the State, that it may be the greatest possible benefit to the individual members.

* * * *

We have often had occasion to commend the organization and the work of the New York State Association many times, and have expressed the hope that railway men in other States would give their State associations the support accorded to that in New York State. While it is undoubtedly true that many of the State associations are doing good work and have the hearty co-operation of the street railway managers of the States in which they exist, it is undeniable that it is not true of all of them, while many States have no associations at all. That many benefits are to be derived from co-operation and united action is indisputable, and as the street railway companies are largely under the supervision of State authorities, membership in State bodies furnishes the means by which the companies can best unite to present their claims and to secure the benefit which organized action is sure to bring.

* * * *

Some of the State associations are organized and conducted purely for executive action, others largely for social purposes. The New York State Association has, wisely we think, always made the discussion of technical questions involved in street railway operation the important feature of its annual gatherings. This has attracted the attention of the operating officials and managers of the smaller roads, whose time is devoted principally to questions of operation. The papers have usually been of high merit; this year extremely so, and, being limited in length, between ten and a dozen subjects are usually brought to the attention of the delegates for discussion. The advantages of a convention of this kind are shown by the fact that the attendance at Buffalo last week was not limited to railway managers in New York State, but, although purely a State convention, companies of other States were represented and participated in the debates. Under these circumstances, it may seem somewhat ungracious to criticize in any respect the meetings of the association. We still believe, however, that the value of a convention of this kind lies chiefly in the discussion which follows the readings of the papers, as this discussion not only brings out the opinions of the different delegates on the subjects treated, but even elicits additional points from the person reading the paper. We hardly think that this point will be questioned, so that any method by which the discussions can be encouraged is worthy of serious consideration. We believe that this can best be accomplished by following the practice of most scientific bodies in conventions of this kind in having the papers printed and distributed to the members some time before the convention, and appointing leaders who will be prepared in advance to open the discussion on their respective

topics. Under the present plan, while a delegate may be apprised of the subjects of the papers to be read, he can have no idea of the way in which these subjects will be treated or the points to be brought out by the authors of the papers, nor can he always remember all the facts stated in a paper, upon hearing it read once at the convention. If, however, he had the paper before him in type before he went to the convention, he could discuss the subject under consideration to much better purpose than would otherwise be possible. That this is true is proved by the fact that the "special topics for discussion," of which notice had been previously given, brought out much more experience than did the remarks on the papers themselves. Again, if the papers were printed, the time of the association need not be taken up by the reading of them in full. Instead they could be presented by title or abstract, and the entire time at the disposal of the association could be devoted to discussion.

* * * *

Another point of value to the association brought up in the discussion was in regard to attendance, and a reference was made by Mr. Vreeland to the methods employed in regard to the attendance at the meetings of some of the steam railroad associations. In these associations regular delegates are sent from the different companies to the conventions, and the fact as to whether they attend the meetings to which they are delegated is ascertained by a roll-call at the beginning of each session. In this way the presence of each delegate is assured, and if any point requiring the concerted action of the members is brought up, the association as a whole knows that a delegate from each road interested is present, either to give his approval or to name his reasons for dissent. While this arrangement, in one sense, may be more important for steam railroads, which interchange rolling stock and thus need certain standards to a greater extent than do street railways, yet we see advantages in a course of this kind. Whether or not any such regulations will be adopted by the association, the suggestion is certainly worthy of consideration.

* * * *

Taking up now the papers themselves, we find that they divide easily into five classes: First, the relations of the officers of a company to the employees, represented by Mr. Connette's paper; second, the relation of the company to the public, represented by Mr. Uebelacker's paper; third, technical papers, relating to electric railway operation, covered by the papers of Messrs. Mann, Nostrand, Henning, Norris, Nicholl and Armstrong; fourth, the legal department of railway operation, as related to damage suits, covered by Mr. Patterson's paper; and fifth, new motive powers, discussed by Mr. Cooke.

* * * *

Mr. Connette's paper, which was printed in our last issue, was received very favorably by the association, and showed that the principles laid down by him were regarded by those in attendance as sound in every particular. Mr. Connette's position indicates that the most successful managers at present do not regard their employees as machines but as fellow-citizens, and that corporation managers and directors have souls, even if the corporations themselves do not. He believes that this position is not only sound ethically, but profitable in a business way, and that that road is the most successful which insures the co-operation of the employee as well as his service. The discipline should be kind and considerate, and at the same time firm and positive, and there should be no prejudice or favoritism in the management of the men. At the same time merit should be rewarded, where possible.

* * * *

The paper presented at the convention by Mr. Uebelacker treated of the management of a combined system affording electric railway, gas and water service. Consolidations are the order of the day, and our readers are familiar with those which comprise several railway companies or railway and lighting companies. That all the public utilities can be combined under one management is not so familiar an idea, although Mr. Uebelacker believes certain economic advantages can be derived from such an organization. This lies not so much in the reduction of the operating force as in a better utilization of its energies and a co-operation between the different departments.

* * * *

The technical papers presented at the convention were of a high standard. The increased use of the storage battery as a station auxiliary was strikingly shown by three papers, one of which described its use on a small road, while the other two treated of its use on a large system, as in Buffalo. In all cases the authors considered that the benefits derived from its use were considerable. Mr. Armstrong took up the subject of electric railway power transmission, a subject of growing importance with the increase of electric railway mileage and the distance to which the power is transmitted. Mr. Mann discussed the power station, outlined the principal losses and showed where economy is possible. He believes the greatest liability to loss is in the fire room, and too much attention cannot be given to insuring a perfect combustion under the boilers. Mr. Danforth read two instructive papers, one on "Rotary Transformer Stations," the other on "Snow and Snow Plows." The former described the general practice of the International Traction Company, whose work in the utilization of alternating current for railway service has been of the pioneer character, and this paper is of great value to those who employ or are intending to employ alternating current for driving rotary converters. His paper on the snow plow was a careful consideration of this question, and as this company has developed, from its own experience, a number of different plows, his conclusions will be useful to those who have heavy snow falls to contend with. His opinion is, briefly, that under the conditions existing in Buffalo, several different plows are required: a nose or share plow for light and medium work, a rotary for heavy work, and a steel broom sweeper for packed or wet snow. The Rochester & Sodus Bay Railway was described by Mr. Nicholl, of Rochester, whose paper was listened to with much interest. The line is a new one, embodying the latest improvements in interurban work, and is a good example of this popular type of road.

* * * *

The subject of Mr. Patterson's paper was on the best method of handling accidents from the legal standpoint. This is an important subject—much more important than managers often think, until postponed damage suits rise up to confront them and condemn procrastination. Mr. Patterson called attention to a growing evil in the rapid increase of damage suits, and showed that in the case of his own company, claims for damages have increased very rapidly during the last few years, and these entirely out of proportion to the actual injuries sustained. This would seem to call for legislative relief, and some way should be devised for preventing the unreasonable damages too often awarded by oversympathetic jurors.

* * * *

The paper by Mr. Cooke on the "Compressed Air Motor" was the first paper on this subject presented at a street railway convention, and attracted great attention. The managers of the New York system think so well of this power that they are going to great expense to determine its value for railway service, and Mr. Cooke's paper, as defining what has already been accomplished, was a most valuable contribution to the science of street railway operation. The paper received the careful attention of those present.

* * * *

A word should be added in regard to the large attendance of supply men at the convention. This attendance has come to be a feature of all street railway conventions, and properly, too, as the manufacturer is as much interested as the railway manager in making a success of electric railroading. The number of these "outside delegates" at the Buffalo convention was extremely large, and the interest taken by them in the technical proceedings greater than usual, both of which facts were favorably commented upon by the delegates present.

As a whole, the convention was marked with more solid work with less diversion than ever before, and added greatly to the already high prestige enjoyed by the New York State Association.

The Annual Convention of the New York State Street Railway Association

Four of the papers presented at the Buffalo meeting of the New York State Street Railway Association, on Sept. 18-19, were published in the last issue of this paper. The proceedings of the convention follow:

TUESDAY, SEPT. 18

The convention which met at the Iroquois Hotel was called to order by G. Tracy Rogers, of Binghamton, N. Y., president of the association, at 10:45 a. m. After the roll-call the president delivered his annual address. This was published last week. Secretary Robinson then read the report of the executive committee. It is given below:

REPORT OF EXECUTIVE COMMITTEE

MEMBERSHIP

The tendency of the times continues to cause the consolidation of existing railroad properties, and necessarily leads to the withdrawal from active participation of many of the old and valued members who have, for a long time, been associated with us. In spite of this loss, we are happy to have enlisted the support of several new companies, which are about to embark in active construction. Our membership now consists of those companies which represent the bulk of capital invested in the street railway enterprises of the State.

We have pleasure in stating that the Elmira & Seneca Lake Railroad Company, the Black River Traction Company and the Rochester & Sodus Bay Railroad Company have joined our association during the present year.

We regret to find that there is a number of companies which are not members of the association, and urge upon the present members that determined and persistent efforts be made to secure the union of every outstanding road in the State with the association.

LEGISLATION

The State Legislature last year continued to be the producer of a large number of bills. While 245 different bills touching organization, construction, operation and taxation were introduced, but few of them made progress. Only one objectionable bill reached the Governor, and was terminated by his veto. Such a volume of legislation required watchfulness and care on the part of the officers of the association, and careful study by the counsel of the various members.

Many members of the Legislature are entitled to an acknowledgment of the unvarying courtesy and attention shown by them to the street railways in their careful consideration and just disposition of the numerous bills presented to the committee.

The association is to be congratulated on having for its counsel before the Legislature Meyer Nussbaum, of Albany. Mr. Nussbaum's early connection with the Senate has been of great assistance in securing for the association a proper presentation of various legislative measures, while the result attained has been mainly the result of his conscientious and felicitous presentation of the matters in hand.

H. H. VREELAND,
W. CARYL ELY,
T. J. NICHOLL,
C. L. ROSSITER,
G. TRACY ROGERS,
Committee.

A resolution was then passed ratifying the action of the executive committee in postponing the date of holding the convention from Sept. 11-12 to Sept. 18-19.

The treasurer's report was then read:

SUMMARY OF TREASURER'S REPORT

Total receipts during year	$7,050.64
Total expenditures during year	4,948.15
Balance in hand	$2,102.49

Then followed the reading of the paper on "Railway Power Transmission," by J. H. Armstrong. This paper was published in full last week.

Mr. Norris.—How much more current will be required with induction motors than where direct current is used?

Mr. Armstrong.—About 15 per cent as an average; 15 or 20 per cent for railway work. With stationary motors it is possible to get along with from 12 to 14 per cent, but in railway work fully 20 per cent more would be required than in the direct-current system.

The next paper read was on "Accidents on Street Railways, Methods Employed in Handling Same, and Preparation for Trial," by D. W. Patterson. This paper was also published in the last weekly issue.

Mr. Nicholl.—I would like to inquire of the gentleman what method he uses to precede the action of these ambulance lawyers?

Mr. Patterson.—That is a matter of detail for the operating department. The moment an accident occurs it is reported by the crew of the car at the depot. It is then telephoned down to the claim department, and some one is immediately sent to look after it. The witnesses are at once interviewed, and their statements taken. After that, the case goes into the hands of investigators; each report going through two or three departments in that way, so that when the case is brought to suit, we have a fairly good idea of what the accident is about.

Mr. Nicholl.—Do you find that you generally make a better settlement by being promptly on the ground, or by waiting for the parties to show up?

Mr. Patterson.—That is a difficult question to answer. There are some cases which it is always better to settle in the first instance. There may, perhaps, be an injury on the spine, similar to a case that happened in Brooklyn. It could have been settled for perhaps about $100 before the lawyers got hold of it, but by the time they finished with him he was brought into court on a stretcher. A great many cases are settled immediately after the accident.

Mr. Robinson.—Mr. Nicholl, in answer to your inquiry, I would state that so far as the Metropolitan is concerned, we divide these accidents into several classes. Of course, those which arise from collision of cars and defective machinery are settled at once. We have investigators, trusted men, who are given money and sent to the injured parties' houses to make as prompt a settlement as possible. So far as street crossing cases are concerned, we do not look for the injured parties at all. The accidents are so numerous that we feel that after they come down to suit and are about being reached for trial, two years being about the shortest time in New York, settlement in that class of case can then be made as speedily as in the beginning. Of course, there are serious accidents which you cannot settle quickly. They run for periods of three or four months before anything can be done with them, and even then it is quite impossible to bring about a reasonable settlement. It is very difficult to say, when the cases get into the hands of lawyers in New York, what is the best method of handling them as a general proposition. There are a great many lawyers who live on accident business in New York. They know the value of a case; do not wish for a settlement, and do not allow their clients to settle. We prefer, as a matter of protection, to litigate with them. There are a great many lawyers having cases against us who have been victims of the company. We have succeeded in defeating them, and in those cases we can settle with the plaintiffs as if we had seen the plaintiffs before. Sometimes we have as many as sixty cases on the calendar, but they will dwindle down to fifteen or twenty when it comes to the time of trial. As I say, the system we use depends as much upon the lawyer who has it for the plaintiff as it does upon the character of the accident.

Mr. Wason.—When a case gets into the hands of a lawyer, do you always settle with the lawyer, or do you sometimes go direct to the injured party?

Mr. Robinson.—That depends upon the class of lawyer.

Mr. Cooper.—Of course, it is considered unprofessional for one lawyer to settle a case after it gets into the hands of another. But don't you think it is a good rule, where a lawyer gets a claim against a street railway company, and instead of going to the party against whom he has the claim, goes direct to the court house with it, don't you think then that we are justified in settling it outside of the lawyer?

Mr. Robinson.—That is a question of legal ethics which is very difficult for me to answer. I occupy rather a divided position, in being both a director and a lawyer of the Metropolitan Company. I can only say from our own standpoint, that there being so many of these cases we do not feel it an insult for lawyers to bring a lawsuit. As soon as they do, we throw up our hands and tell them that they had better litigate, as age will improve the quality of their claim. (Laughter.) I found the other day that I had about six thousand cases brought by lawyers which had never got beyond the serving of summons and complaint.

Mr. Vreeland.—There are just two points in Mr. Patterson's paper to which I wish to refer. With reference to what has been said later, there is a question I would like to speak upon. One was the number of accidents, which was spoken of in the paper. With our system of handling the accident business in New York City, which was started some seven years ago, and has been changed from time to time, better methods introduced, etc., we determined that it was necessary to investigate everything. We found, a few years ago, when our accident cases were handled by several lawyers representing the several properties that make up the whole system, that all the records in the office of the lawyer were the reports furnished by the motorman and conductor on the accident; and also, that only what might be classed as accidents that resulted in severe injury, were reported. Not long since a manager of one

of our syndicate properties came to New York and asked what our monthly report and yearly record of accidents showed. We told him, and also stated the number of car miles, and the number of miles of street covered. He said, "That is something awful," and he cited their record. When we inquired the character of accidents they investigated, we discovered that it was simply where somebody had a leg off, or an arm off, or a skull fractured. Our system is that if a person falls and gets up and brushes his clothes off, apparently unhurt, it is the duty of the conductor to report it. We hold so rigidly to that rule, that our discipline with motormen and conductors is more strict in that particular than in almost anything else. If an accident report comes to the office indirectly, and not through the men who are handling the cars, we mete out the severest discipline that is administered in any connection. Our sixty accidents, in their final result legally, as indicated by Mr. Robinson, may melt down to ten; but we have the information. We found that the worst cases presented to us were often of this small class which were not considered worthy of investigation, and when it came to a question of suit we had no defense; did not even know on what car it occurred.

With reference to the question of stopping cars, distances, etc., a few years ago we had marked on one section of our track the distances, and then had cars run over this section at the maximum speed attainable. They were then to be stopped by the men, who were not to touch their brakes or grip until warned by a torpedo, at which time they were to stop the car as quickly as possible. The distance was measured, and made a matter of record.

When the Railroad Commissioners of the State of New York made their brake tests on our system, they had the best mechanical appliances for indicating speed, distance, etc. In their tests the car under trial was filled with newspaper men, and the man who had charge of the brake that was being exhibited wanted a speed of 15 miles an hour, in order to show in what distance the car could be stopped, and it was found impossible to run the car 15 miles an hour. We could not get up that speed. I immediately turned to the Railroad Commissioners and all who were in the car and said: "Gentlemen, I would like a record made of that. There never was an accident in New York City where it was not reported that the car was bowling along at 45 or 50 miles an hour. Now, here is an opportunity to show that that is impossible." Of course, you know that our lines are run through congested districts. For instance, on our cable road the cables run 6, 9 and 14 miles an hour. By this speed test we have had put very fully before our men the matter of the distance it takes to stop these cars, even with the most improved braking appliances. There were all kinds represented; track brakes, electric brakes, and a combined track and wheel brake; and the tests were very carefully kept by our men, so that we have a record of the distance actually traversed by these cars under all braking conditions before they could be stopped; and I am free to say myself, that I should have understated rather than overstated the distance in which it was possible to stop one of these cars if it had not been for the record.

Mr. Schoeplin.—I am manager of a small suburban street railway, and we have had a number of accidents. My experience has been that the best thing to do is to get ahead of the ambulance lawyers; keep the case out of the hands of the attorneys, if possible. Our road had been in operation about three weeks when we had two serious cases. I immediately started to keep the cases out of the hands of the attorneys. There were thirty or forty in the case, all the neighbors working for some attorney or friend; but I succeeded in settling the cases without any attorneys for $2,500 each, which I think a very good settlement. We have had a number of accidents in the last two years, and I have found that the best thing to do was to keep them out of the lawyer's hands, and settle them just as quickly as possible. We had one case which it was necessary to fight in the courts, and the witnesses we had, the conductor's witnesses, were chums of the young man who was hurt, and were unreliable. The only record that helped us was the police record. If you can get a police record of the accident, it goes a great way with the jury, and it was in that way we won. The jury brought in a verdict of no cause of action. It caused us three weeks of labor, and cost much money to prepare the case. It would have been cheaper to have settled it. Of course, city street railways who have attorneys they pay by the year, can afford to carry cases along for two or three years, but I think most of us find it more desirable, and I believe the Buffalo Street Railway Company has adopted a system of settling of cases quickly.

Mr. Wason.—On our suburban road it is a question whether we have more accidents on the highways or on the private ways. There are several of the suburban roads which have private rights of ways, and have serious accidents. They are bound to cross streets, and people are bound to walk on the track. Where we are paralleling or running on a highway, the man driving on the highway is continually on the watch for a car, and it would almost seem to me, from our experience in both directions, that there are really less accidents on the tracks by the highway than on the private roads. This, on the face of it, would seem a little peculiar, but I am inclined to think it is a fact. I haven't the figures, but I think that of two roads, one running east and the other west, one on the private right of way all the way, and the other on the highway, our accidents have been, in point of dollars and cents, about the same. We try to settle our claims as soon as the accidents occur, rather then let them go into the hands of lawyers. We cannot afford, as a suburban road, to employ lawyers by the year, as city roads do, and I agree with the gentleman of the suburban road, who spoke just now, that for a suburban road it is best to settle the claim promptly. We have settled a number of our fatal cases considerably cheaper than the gentleman who spoke. On our city roads, of course, it is about the same, in a small way, as Mr. Vreeland outlined as the policy of the road in New York.

Mr. Cole.—Mr. President, I have recently been in a number of cases as an expert, and I have noticed that nine times out of ten the case has been sent to the jury to determine upon the question of speed; where they might possibly have obtained a non-suit if it had not been for the question of speed. If, as soon as the accident occurs, the master mechanic, with the witnesses, took the car out and put a speed indicator on, there would be no question as to the speed of his car. Twice recently I have obtained a non-suit where it has been just the question of speed.

Mr. Hasbrouck.—Corporations have no souls, you know, but it is wise to show a sympathy. Before it grew to such tremendous proportions with us I used to show a good deal of sympathy, and I have settled a case for $1000 sometimes, giving a man $100 in money and $900 in sympathy. (Laughter.) It really worked very well. They often say: "Yes, you soulless corporations never come near us." I received a letter from one of that class of lawyers who always now takes the precaution to serve us with a notice of lien after he serves his summons. He told me that Mrs. Fagin had been injured; that she lived so and so. I immediately went to see Mrs. Fagin myself, and within an hour I settled with her for a small sum. The lawyer was highly indignant when he found that I had been to see Mrs. Fagin and settled with her. I told him that there was a certain courtesy between lawyers, perhaps, but I did not own a cent's worth of courtesy. (Laughter.)

Mr. Harrington.—I am manager of a little road down in Camden, N. J. We average about five or six accidents a day, including everything. We sometimes settle behind the lawyer's back, in the case of lawyers for whom we have not any respect, of which we have a few. We have more accidents on open than on closed cars. We have several cases where employees have been injured and which came up after they had been discharged. We found that our accidents cost us each year about 2½ per cent of our receipts. Last year it was 7 per cent. We think it due to the fact that the public is becoming bolder, and it is a question, in our mind, whether it is expedient to settle as promptly as we do.

Mr. McCormack.—When I was with the Brooklyn Rapid Transit Company a verdict was given there on account of a contractor being killed on the Third Avenue line, and several witnesses claimed that the car was running 30 miles an hour. The same car was tried and the best speed obtainable was not quite 22 miles an hour.

Mr. Hasbrouck.—Examination of a case will sometimes elicit some interesting facts. I remember one case where a party claimed to be injured for life, having lost a finger. When we got down to the facts we found he was a gambler, and could not handle the cards without the finger he lost; therefore his occupation was gone. (Laughter). I recall a very interesting suit brought against the People's Line of Steamers a good many years ago, where the man made out his case. He was sleeping in the under berth and the man above him broke down somehow and fell upon him, and, as a result, he lost an eye. He got a verdict for $5000 or $6000. The People's Line carried the case up. In the course of two or three years it happened to occur to them that this suit was brought in 1866 for the loss of an eye, and they discovered, on examination of the military records, that this man had been examined for military duty when the draft occurred in 1863, but was rejected because he had but one eye—two years before the accident occurred.

E. G. Connette then read a paper on "How Can We Increase the Efficiency of Employees?" This was published last week.

Mr. Godfrey Morgan.—This paper introduces a subject which has been up at least four times in this association, and once or twice in the National Association, and that is the matter of rules and regulations for conductors and motormen, and the standardizing of a certain form of rules for them. I have discussed this matter with the inspector of the board of Railway Commissioners of the State of New York, Mr. Barnes. He asked me a short while ago if we had a book of rules. I said no; that we had had a number of discussions at the Street Railway Association of the State, at which they were going to take up and standardize a set

of rules for the government of motormen and conductors. I rose more particularly to find out where that resolution had gone and what probability there would be of our ever getting a standard set of rules for motormen and conductors.

The President.—If I remember correctly, this question was dropped on account of objections of some of the small roads to some of the rules proposed because they would not be applicable to them. The fact is, it would be impossible to adopt a set of rules governing the Brooklyn Rapid Transit, the Metropolitan and my little road, as well as some other roads.

Mr. Morgan.—I do not believe the association can make rules; in fact, I would be opposed to a set of rules which would be fit for New York or Buffalo, but would not be applicable to a line like the one of which I am manager. Now, of course, I don't wish to get up a set of rules and have another set adopted by the association put before me, and have to go to the expense of printing this other set later on. If there is any likelihood or probability of any such rules being formulated, I would like to at least know what we are going to do before we get our old rules printed.

Mr. Cooper.—The National Association had a committee appointed and got up a set of rules which we supposed to be a general set. I would like to ask if you know whether the Railroad Commissioners have any idea of formulating a set of rules for this State.

The President.—All I know is that two or three years ago they suggested a set of rules, and further suggested that this association take up the matter, and the outcome was as I stated before. I remember that on account of the difference between the large and small roads a uniform set of rules could not apply.

Mr. Cooper.—Would it not be as well to make it the sense of the association, in the form of a resolution, to ask the Commissioners not to do aything?

Mr. Ely.—The secretary suggested a resolution which, it seems to me, would be a very good way to deal with this question, and for the purpose of getting the matter up on the question, I will offer the following:

Resolved, That the committee to which this subject was heretofore committed be, and the same is hereby discharged, and that the president is authorized to appoint a new committee of five, to consist of representatives from roads in large and small cities and suburban roads, to take this subject under consideration and report to the next convention.

The motion being put to the meeting by the president, it was carried unanimously.

Mr. Vreeland.—I just want to say a word on that rule question. I had more or less to do with it, as there was considerable work done in my office in connection with the matter. We were putting in, at that time, a set of standard regulations. So far as the question of large and small roads is concerned, I was a member of a committee that was appointed to formulate a standard code of rules and train orders for the steam railroads of the United States. We had an engineer come to the East who knew nothing about our train orders or our general methods, and there was a case to be heard in the upper part of this State where there were three railways using one terminal, night and day, and every one of them had a different method of giving train signals with lanterns in the same yards. The same thing occurred over in New Jersey, and it was decided that we could standardize the essential rules for the government of employees. There was an objection made by the small roads at the association meeting, and it was decided that there should be a certain code of rules formulated, running from one to 106, and the same as to train orders, etc.; and that any railway which, by reason of single track or any local peculiarity, required it, could add to any rule. If the rule was No. 80, they could make a rule 80A or 80B, but they could not depart from the regular numerical order of the rules. There is not a railway company in the United States which is not working under those rules. There is not an engineer on the Pacific Coast who could not run under the train orders of the Boston & Maine or Maine Central. The train signals are exactly the same throughout the United States. A brakeman on one road for twenty years can go to another road and have nothing to learn but the local peculiarities.

We have a number of regulations that are general in their character, and would refer to the work of a motorman in any part of the country. It is necessary now, if we get a motorman from any part of the country, to find out how he has been following regulations. Our men took up the subject and made a standard set of rules, which apply on all the roads we are running. You will find throughout the United States that where there are single-track roads the rule is that trains traveling in one direction for twenty-four hours have the right of way. If by reason of the local conditions of single-track roads it was necessary to change that, the change was made by a rule A and rule B, that trains for twelve hours running in a general way had the right of way, etc. We are working under a set of rules now in the Metropolitan. I obtained a set of rules of every large system in the United States, and put a special committee of my men to work on them to pick out what they considered the best and to standardize a set of regulations general in their character. I then gave every superintendent and foreman the right, if necessary, to make changes in those rules. We are working under one set of rules on all our New York properties, and any others around the country under the control of the syndicate.

The next paper read was entitled "Storage Battery; Its Use on Small Roads," by B. B. Nostrand, Jr. This was published last week.

Mr. Nostrand (in answer to questions.—The small engine that we usually operate, running a 60-kw machine, is a simple engine. It just happened so. The other is a compound engine—Westinghouse. The batteries have been in operation since June, 1899. The only expense in the way of repairs have been in the neighborhood of $20. We have had no difficulty with the plates buckling, or anything of that nature. We operate three cars in the morning, and from about noon we run four cars, except on holidays, when we run five cars. We have no arrangement with the manufacturers as to depreciation. We bought outright the batteries without any guarantee as regards depreciation.

Mr. Blizard (of the Electric Storage Battery Company).—In reference to the matter of maintenance, there was a time, when we first started in business, when we had to overcome a very unfortunate reputation the storage battery had made. It was then necessary to give a guarantee, but now we find it is not. We not only guaranteed our batteries, but we guaranteed the men who operated them. Of course, a battery is not indestructible. We have no control over the men who operate the batteries, and there is no reason, under these circumstances, why we should give a maintenance guarantee. The average cost will vary from 3 per cent to 8 per cent or 9 per cent in residential plants, where the batteries are handled by gardeners. In railway service it will run from 5 per cent to 6 per cent. That does not mean that you spend 5 per cent every year, but at the end of five years you may have to spend 20 per cent of the original cost.

The convention then adjourned.

AFTERNOON SESSION

The meeting was called to order by the president at 3 o'clock. The first paper was by Thomas Henning, superintendent of the power house, Buffalo Railway Company, Buffalo, N. Y., and was entitled "Storage Battery." This will be published in the issue of Oct. 6.

The next paper read was entitled "Description of the Rochester & Sodus Bay Railroad" (41 miles), by T. J. Nicholl, vice-president Rochester Railway Company, Rochester, N. Y. This is published elsewhere in this issue.

Mr. Nicholl.—I was asked about the maximum speed that is made, and I will say that I judge it to be about 35 miles an hour. We can make 50 miles, but don't get a chance to get up to that speed.

The President.—I notice that some of the roads are draining their tracks on their own right of way, the same as steam roads. What is the custom of the suburban roads in Ohio?

Mr. Wason.—Where we can, we follow the steam railroad practice. I would like to ask whether the suburban railway managers attempt to keep the weeds out of their tracks? There are advantages and disadvantages in having weeds in your tracks; they do away with the dust but at the expense of your ties.

In reply to Mr. Wason's question on the subject of weeds, it was stated that it was the practice of one road 4½ miles long to trim the weeds down to the height of the rails during the summer and to grub them clean in the fall to prevent catching the snow in winter.

The President.—We have a little road that is grubbing weeds all the while.

Mr. Nicholl.—I have quite a good many miles of suburban road outside of this Rochester & Sodus Bay Railroad, where we have a great deal of grass and weeds, and we keep them down by salting the track. We put several carloads of salt on the track every spring, and that keeps the growth down. It is only about three years ago we started that practice. So far, there are no evidences of deterioration in the rail bonds.

The President.—In regard to draining the track, where we covered it up and the weeds grew, I had to put in new ties, and where we drained it the ties are in fair condition to-day.

Inquiry was made of Mr. Nicholl in regard to his telephone stations along the line, and what method he used for dispatching trains.

Mr. Nicholl.—We have a telephone station wherever we have an agent; that is, at all the villages and at one or two points besides, where we are obliged to use men. For instance, at the car houses

and sub-stations. The form of train orders is very similar to that used by the steam railroads. The train dispatcher gives the order over the telephone, and then has the operator repeat it back to see that he has got it all right, but with the conductor's signature. Of course, we cannot possibly have the conductors coming in and repeating to the train dispatcher; therefore, we rely upon the agent.

The next paper was entitled "Tests Buffalo Railway Power House," by Prof. Norris, Cornell University, Ithaca, N. Y. It is published elsewhere in this issue.

The president then appointed a nominating committee, consisting of Mr. Cooper, Mr. Cole and Mr. Brackinridge, after which the meeting adjourned.

A trip was then taken to the Cold Springs station of the International Traction Company, and later to the Pan-American Exposition grounds, as described last week. The annual banquet was held in the evening, and an account of it was published in the last issue of this paper.

SECOND DAY'S PROCEEDINGS

The meeting was called to order by the president at 9:45 a. m. The first paper read was on "Precision in Steam Power Making," by A. S. Mann, assistant engineer Metropolitan Street Railway Company, New York. Owing to the sickness of Mr. Mann, Mr. Robinson will read the paper. This paper is published elsewhere in this issue.

The second paper presented was by H. D. Cooke on "Compressed Air Motors," and was read by Mr. Himely, of New York. This is also published elsewhere in this issue:

Mr. Thompson (general manager Buenos-Aires Tramway Company).—It seems to me that there is one word in the paper which needs a little explanation, and that is reciprocation. The great thing steam railroads are looking forward to is the substitution of motors for steam. I understand that in compressed air cars there is considerable jolting, which I attribute to the reciprocating action of the motor, and my only reason for rising is to ask the gentleman whether any attempt has been made to employ compressed air in the rotary motors, which will do away with the reciprocating action leading to the jolting.

Mr. Campbell (of the Compressed Air Company).—I would say in answer to the gentleman who asked about the rotary engine, that while they have been experimented with for a great many years, they have never become of commercial value. There is no economy in them; there is a loss. The mechanical engineers have never been able to obtain the same results as with reciprocating engines. As to the question of unbalanced motion mentioned, it depends entirely upon the reciprocating parts; but the lighter the reciprocating parts the nearer we approach to a perfect motion. But where the parts become very much over a 20-in. cylinder, then it becomes a serious matter and causes a hammer blow, while this does not exist in small motors.

Mr. Thompson.—The gentleman has missed my point. The drift of his argument is that it does not affect the structure of the carriage. The question of balancing motors is one upon which every one has an opinion. At any rate, it produces severe jolting. The question of discomfort to passengers is one which relates more to the proportion between the weight of motor and car. In the case of a street car motor, the motor is scarcely too light.

Mr. Campbell.—I can say that in relation to balancing, we have two conditions; these are the weight and reciprocating power. If we move them about, if we take the 20-in. wheel and counter-balance, we have a different result at 20 miles an hour than we have at 30 miles an hour. We cannot counter-balance that perfectly; we can partly. Theoretically, it does exist in any motor, any size, any weight of motor. It exists, but when we come to a smaller motor, the resistance and the effect of vibration is resisted by the weight upon the wheels. It is always the downward motion on the counter-balance that makes the pressure, or what we call the hammer blow; and that is why we have to consider conditions when we come to reciprocating parts; and while I say it does not exist in street car motors, I say it is of such small moment that we do not feel the effects of it.

Mr. Thompson.—Is it not the case that every compressed air motor hitherto made has produced a jolting motion in the car greater than any electric motors?

Mr. Campbell.—Yes, I agree with you that it would be more perceptible than in a rotating motor.

Mr. Thompson.—The compressed air motor is put forward as a competitor of the storage battery; but the only advantage I can see is that it is not so likely to trouble in winter. The practical working objection to the compressed air motor I have always understood to be the jolting sensation produced. In the course of your remarks you said that the rotary motor had not yet been made a commercial success for such small motors as you use on street cars. The only suggestion I threw out was to put the compressed air motor on a more equal footing with the electric motor.

Mr. Campbell.—There is no increase of power in a rotary motor. We have got a fundamental principle in mechanics; it is that in a position a number of pounds moved a given distance determines the power. The difficulty has been in mechanical work in making these positions strike. Again, in getting the extension of same, we have not yet been able to make all joints tight on a rotary engine that will give the best results. We have not been able to operate the extension. For the purposes it has been put to for torpedo boats, economy is no object. It is speed at any expense. If it can be developed it is a very great advantage, and may answer all purposes for a reciprocating engine.

The next paper was by C. F. Uebelacker, of the Elmire Municipal Improvement Company, on "Practical Experience in the Operation of Combined Public Franchises by One Company. Its Advantages to the Public and the Corporation." It was read by Mr. Robinson, and is published elsewhere in this issue.

Mr. Fenner.—Our plant, originally a railway plant, did buy in electric light and power, but didn't find any particular additional expense attending it, so far as the power house was concerned; and we did buy the gas plant, but did not make gas. We bought it under a ten-year contract with Dunkirk, where the gas was made and piped to Fredonia. That is about to run out now. Our power house burned last winter, and we are putting up a new one, in which we expect to manufacture gas, and we expect to manufacture all the gas we need, which will be about 6,000,000 ft. in a small town, with the addition of one man, because other employees can be utilized. In that way there certainly will be great economy, and we can probably make gas much cheaper than if we had an independent plant. If we did not have this property, our combination, which combines a lot of capital, would be valueless. There are not passengers enough, although the fare is 10 cents, between Fredonia and Dunkirk. There are only about a quarter of a million during the year, which would not be enough to pay any return. But with the steam heat we put in, using our exhaust steam, we get about $5,000, which is like found money. Taken all together, it is a valuable plant and the stock is par; but if it were not for the combination the stock would be worthless.

Two papers by R. E. Danforth, superintendent of the International Traction Company, were then presented to the association, one on "Snow Plows," the other on "Rotary Converter Sub-Stations." They will be published later.

The President.—The first topic for general discussion is "Repair Shop Methods, Including Handling and Distribution of Supplies."

DISCUSSION ON REPAIR SHOP METHODS, INCLUDING HANDLING AND DISTRIBUTION OF SUPPLIES

Mr. Nicholl.—I did not come here with the idea of being called upon to make any remarks on a subject of this kind, but in order to bring the matter before the meeting I will say that our plan of handling supplies is quite a complete one. At any rate, we have a book we call our inventory book, which is printed and in the hands of all our employees. It gives a number to every article that we use on the railroad, so that when a requisition is made we only have to put down the number of the article. For instance, every screw has a number, etc. The manner of handling our supplies is this: We have a purchasing agent, who does all our purchasing of every name and nature. Every piece of work ordered, even outside, is made on a requisition to the purchasing agent, so that there may be a proper order for that work or material as the case may be. He has a system of keeping the inventory constantly before him, which is quite a complicated affair, and it would be hardly possible for me to describe it without having the blanks to show you. But it is arranged so that as each article comes into the storeroom, numbering about 2500 in all, it is put on this special sheet for that purpose, under that head and number, and kept up for each day, week and month. On the other side of the sheet is an account of the articles as they go out. We have a box set apart for each kind of supplies.

That will probably suffice to give you an idea of the storeroom. Each foreman of each shop, whether in the armature room, the field room, the truck repair shop, the carpenter shop or whatever it is, makes requisition which goes to the master mechanic for his verification. This goes to the storekeeper, and the articles are issued. Then, each job that comes into the shop, of whatever kind, is numbered, and all material that goes into that job and the labor is charged to that job by the foreman of the shop. In that way we get a pretty good idea of things. Each day we know just exactly what we are doing. In fact, I have a report on my desk every day showing in detail everything purchased and that which has gone out. It serves to keep the office in line. They don't know but that I go over each item. Our repair shops are divided into a carpenter shop, paint shop, machine shop, truck shop, armature winding room and coil room; each one under a foreman, and

all under the master mechanic. Of course, space won't permit me to go into all details, but this will start you.

Mr. Tully.—Our supply department is so very large, and there are so many different kinds of operations, that it is somewhat difficult to describe it. We have over five thousand horses; that means a very large supply department. We have a cable system, which necessitates another system of supplies. Then we have the underground electric, and are now experimenting with the storage battery and compressed air; so that we have five different lines of supplies, three of them very large. Our supply department is one which requires a great deal of attention. I have my requisitions numbered consecutively. I commenced several years ago with No. 1, and I can account for every requisition that has been used; so that any false requisitions that may turn up can be told at once. We check off our bills consecutively on the face of the requisition and copy book. We are just about preparing for a new storeroom. I shall commence in that a card system, keeping an account of material received, etc. I judge from my conversations with the number of railway men who have been to see me, that while we differ in the matter of some details, in the main we are about on the same basis. I report to the auditor once a month.

Mr. Danforth.—Until this year the Buffalo Railway Company reported weekly, but we found we were able to reduce the amount of labor by making monthly reports. At the beginning of the month a list is furnished, having thirty-one spaces, a space for each day, on which the materials issued from stock are entered. The amount issued to each job is marked with the proper date, each day, as the requisitions of the foremen are checked off by a clerk. At the end of the month it is checked up, and a recapitulation sent to the office. We use separate job numbers for mechanical, track and shop work, giving the minor repairs and accounts in the maintenance of those departments a standing job number, which is balanced up every month. The auditor is advised daily of any new work or job numbers issued, with a description of the work. He keeps his accounts by a card system, and can, in a very few minutes, give the management the cost of any piece of work under construction.

The President.—If there is no further discussion or other questions to be asked, we will pass on to the next topic, which is "Selection and Management of Employees, and Methods for Increasing Their Efficiency by Benefit Associations and Other Means."

DISCUSSION ON INCREASING THE EFFICIENCY OF EMPLOYEES

Mr. Vreeland.—In 1881 I was a member of the American Society of Railway Superintendents. Some railways had then had nearly half a century of work, discipline and methods of handling employees. Last Saturday I was requested by the president of the Society of Railway Superintendents to appear before their meeting in October, in New York, and talk on this subject. A committee has been in existence in that society since the early seventies. Men have been changed, other men have worked on the committee. The question of standardizing the time of the United States was a matter of ten years. The question of the standard rules, which this association was going to dispose of for street railway purposes in one year, was up in my early railway days (and I have been in the business for twenty years), and was settled only two or three years ago. It is absolutely impossible to deal with a question of this character without the association, and settle a time for a discussion of each question. Then, if those of you who manage and own railways will say to your employees and your heads of departments who come to this association meeting, "If you can't attend the meetings of the association you can stay home," we will get along very well with this question. It seems to me—and I can speak on this question as a member of the executive board of this association—that it is not fair to the members and president of this association to ask a gentleman who has spent six months in preparing data, to get up and read his paper to a beggarly array of empty chairs. It is not the custom in railway circles of this country. The Association of Master Car Mechanics makes every man sign his name that he was at the association meeting. They do not allow a man to answer for another, and the railway companies keep check of those who attend the session of the convention. The same thing is true of the American Society of Railway Superintendents. There is not a session of that association, and never has been in the past, when every moment is not used for the business purposes of that association. If a man in the room wanted to go downstairs he asked the chair to be excused long enough to go there. And it is impossible for this association to consider questions of a continuous character, unless the members attend the meetings of the association and discuss the questions. A man can get up and generalize on these questions, but I have been working for seven years in street railway circles for the point where we would have some good method for the care and benefit of our employees, and I think we have only started; and if this association can dispose of this matter in ten or fifteen minutes, or one, two or five years, they are decidedly superior in ability to any of the societies of the United States.

The only way to treat the question is as a standing subject of this association. If we want to take it up and discuss it, we must have it stand as a regular topic of discussion of the association. As I said before, it has been before the American Society of Superintendents for twenty years, and this year it is brought up again for discussion. We have had a few words on it for the last few years, but it really has never amounted to anything, as there has been no set time given to it. In the American Society they generally give half an hour to the discussion of that subject in their meeting.

Mr. Clark.—I am quite sure that all in attendance at this session will heartily enjoy all Mr. Vreeland has said in relation to the delegates attending the business session. I know, of my own personal knowledge, that the president of this association and the executive committee have made a determined effort each year to secure at the meeting a large and representative attendance. That they have been successful is evidenced by the increase of attendance each year; but, as Mr. Vreeland has said, it is a deplorable fact that only a small percentage of those in attendance at the convention take an active part and participate in the benefits to be derived from the business meetings, and I think that the president and executive committee will be justified in laying down rigid rules and asking the railways of the State to see to it that their representatives attend the business session.

In relation to the discussion of the very important topics to which Mr. Vreeland has alluded, I would like to suggest if the meeting thinks it pertinent that the subject of "how to increase the efficiency of employees" be divided into several topics or divisions, to be arranged by Mr. Vreeland, and that the president of this association allot to the representatives of the different railways throughout the State such of these topics as he thinks would be most applicable to the situation and geographical location. I think the matter can be taken up in this way so that next year it can be considered as it should be, as it is of vital interest to railways as well as to the country at large. Therefore, I offer the following resolution:

Resolved, That the topic of "How to Increase the Efficiency of Employees" be separated under different heads, to be suggested by H. H. Vreeland, of New York, and that the president allot to the various street railways throughout the State the various sub-topics suggested, and that the representatives of the respective roads prepare to discuss same at the next annual meeting.

Carried unanimously.

The President.—The next topic is "Pavements."

DISCUSSION ON PAVEMENTS

Mr. Cole.—I saw in the papers that Mr. Boyle had a long litigation at Utica, and I wanted to know what the decisions were in those cases. It was largely a case, I think, where they were going to pave with asphalt, and the franchise of the Utica Belt Line stated that where the railways were laid should be paved with a pavement in every way suitable for street railway purposes. The claim was made by the engineer of Utica that asphalt was not suitable, as the concrete overlying the tie caused a vibration, and this vibration separated the pitch from the concrete so that the water trickled through. There was also a recent decision in which the courts determined that the 2 ft. of pavement to be laid outside the rails really meant 4 ft. I wanted to know whether such a decision had really been rendered.

Mr. Nicholl.—I have had a good deal of trouble with the paving question, and I have been trying to get an opinion on that 4-ft. matter. With us it is 2 ft. on either side of the track, and I don't think there has been any decision to the contrary.

Mr. Cooper.—I was told by an attorney the other day that the matter had been decided by the courts, but it was a decision which was subject to reconsideration by a higher court; that it meant 2 ft. on each side of the track. That decision was made last week.

The President.—If there is no further discussion on that subject there is another question we have been asked to talk about, viz.: "Snow Plows."

DISCUSSION ON SNOW PLOWS

Mr. Danforth.—I suggested that this question of snow plows was of great interest to the operating men of this State, and one which could stand considerable discussion. We do not all agree as to the best form of plows, or the best method of operation. It is only a few years, within a decade, that our plows were anything more than a walkaway or scraper. Last winter, in this city, thirty of our plows were levered, placed diagonally across the track under the wheels, and run by electric motors placed in the cab. We have been slowly arriving at the conclusion in this city that this plow is a very pretty affair, but for handling the snow is not what we want. A few years ago, the Thomson-Houston Company

got out a sweeper. The Buffalo Railway Company purchased two. These sweepers were equipped with steel brooms. While the motors last these sweepers are as fine a machine for city work as can be obtained. It is impossible to spoil them; they will cut anything short of hard ice. They fail in a large drift because of the inability to throw the snow over the sides of the bank. A few years later Captain Ruggles, of Charlotte, devised a rotary plow. He met with fair success and we tried one in Buffalo. The first was rather crude, but we managed to go through 13 ft. of snow; not rapidly, but more rapidly than with shovels, and with less expense. The following winter the Buffalo Railway Company and other lines built rotaries somewhat heavier and double-ended. These rotaries are still being used by this company. We find that in heavy work and deep drifts on the suburban line, and particularly on lines running north and south, these plows are invaluable. They fail in heavy wet snow, as may be imagined, from mechanical defects, not from the fact that the scheme is not right. We have slowly got around to the idea that a snow plow, to be effective in city work, must have traction. We therefore, last winter, built thirteen-ton, four-wheeled plows; double truck share plows. We placed on these what we supposed were pretty fair flangers. In December the men operating the roads in Western New York had a wet snow before the frost entered the ground. The result was rather disastrous for some of us. The rails, after 6 ins. of snow had fallen, became chilled; wagons and sleighs got in ahead of our cars, squeezed out the water, and there was an inch of ice on the rails. Our light plows were useless; our sweepers would not touch it. Our heavy plows went 100 ft. and then into the gutter. We squirmed out of the difficulty by using rather a unique flanger. Our life guards are so constructed that they are hung to a ring on the platform—an eye rather. We took our switch irons and dropped them through the eye and in front of the back cross piece of the sweeper, and placed a man to rip out the ice as they went along. Later, when 18 ins. of snow had fallen and the light plows had become crippled, this section of Main Street was covered with 15 ins. of snow, pushed down by the sleighs, and no cars or plows on the street, our rotaries happened to be working on outside lines where we could get hold of them. In thirty minutes they were down here, and in another twenty minutes the lines were open. They picked this snow up, tight as it was, and I am sorry to say in some instances broke a few windows. The people in Buffalo knew nothing about the threatened tie-up. When they got up the lines were running beautifully. Later, when we were visited by 4 ft. of snow, our share plows proved invaluable. The levelers were useless after the first 2 ft. had fallen. These heavy share plows, without pushing, kept the lines open and the cars very close to schedule time. They demonstrated their value to us at that time very nicely. Within the next four or five days, when the wind commenced to blow up drifts on the suburban line and these drifts had time to become hard, we found it impossible with a 25-ton, four-motor equipment behind a 13-ton plow, to make any headway through these drifts. We brought out our rotary plows, and while they went, perhaps, only a mile or mile and a half an hour, they went through the drifts. That proved to us conclusively the particular service for which our rotaries could be used. Following this, we have this year constructed heavier double-truck share plows, following practically the same lines in the matter of construction as the year before. A few years ago, as an experiment, we bought a rattan sweeper. I put it on one of the inside lines where the service was heavy, so that there would be plenty of grass and not too much sand to handle. We put it in the hands of the best inspector we had, and asked him, as a special favor, to make a success of the sweeper. At the end of the month he wanted to be relieved of his position. He said he would rather have two 6-ton passenger cars any day than that sweeper. We shunted it onto another division with the same result. The man did not know how to handle the sweeper, and I would like someone to tell me.

Mr. Reed.—The handling of snow varies according to local conditions. The rotary plow, while very valuable on suburban lines, would raise a howl in New York City. Our snows are not, as a rule, very deep. We use the rattan sweeper. The first year we had some trouble because the sweeper itself was not constructed satisfactorily. We run them frequently, otherwise we would not run them at all. In the heavy snows we keep sweepers on not more than ten minutes headway. I have some share plows, but they have not proved successful. We follow up the sweepers with the old-fashioned walkaway, drawn by horses, to keep the snow back from the track as far as possible. In the storm of two years ago, which was the first storm we had to contend with on our underground system, we ran our cars at rather irregular intervals until, I think, about 5 o'clock Monday afternoon, when we were tied up by the conduits filling. After being tied up, it became a matter of shoveling the snow, for which we fortunately had about seven thousand men to call on. We use the electric sweeper entirely upon the electric roads, reinforcing it with the old-fashioned walkaway. We do occasionally have to use on switches, etc., hand power to keep the snow back far enough so that the sweepers can work properly. Last winter we had no trouble whatever, and never have any trouble except when our conduits fill. Nor had we at that time a sufficient number of sweepers. We immediately got other sweepers and share plows, but I do not think a share plow was ever made that was of good service. We keep a good supply of brooms on hand. We have never used the steel brooms at all.

Mr. McCormack.—Our experience with the snow plows that manufacturers give us, a four-wheeled car plow, is that it is hard work to keep the front wheels on the track. In Brooklyn we made a suggestion to the manufacturers which largely obviated that trouble, by putting a lever just beside the rear wheel, so that the force against that would help keep the front wheels on the track.

The committee on nominations then reported as follows:

President, G. Tracy Rogers, Binghamton.
First vice-president, John Boyle, Utica.
Second vice-president, Edward G. Connette, Syracuse.
Secretary and treasurer, Henry A. Robinson, New York.
For executive committee:
G. Tracy Rogers, Binghamton.
Herbert H. Vreeland, New York City.
Clinton L. Rossiter, Brooklyn.
T. J. Nicholl, Rochester.
W. Caryl Ely, Buffalo.

These nominations were elected unanimously.

Rochester was selected as the next place of meeting.

At the close of the meeting a trip was made of the cars of the International Traction Company to Niagara Falls, and thence to Dufferin Café on the Canadian side, where lunch was served, and the party enjoyed the view of the upper rapids. Thence the party left for Queenstown, and crossed the lower suspension bridge to Lewiston, returning to Niagara Falls by the Gorge Route, after which they were taken to Buffalo. The trip, which stands unrivaled for beauty of the natural scenery presented, was heartily enjoyed by all, who unqualifiedly expressed themselves as heartily appreciating the hospitality of the International Traction Company.

Practical Experience in the Operation of Combined Public Franchises by One Company *

BY C. F. UEBELACKER

The combination of public service enterprise is the rule of the day. We are all more or less familiar with such combinations as street railway and electric light, or electric light and gas, or, perhaps, all three under one ownership and more or less under one management. We say it is a good thing, that large economies must result, etc.; but when we come to look into the details of organization it is less evident just where the large savings are to be realized. We will leave out of the discussion entirely ornamental office holders on fancy salaries. The constant demand of the public for decreased prices and increased facilities is rapidly replacing them with the working president and treasurer. Combinations are not necessary to achieve these economies.

The advantages which do exist and which are the direct outcome of combination must be divided into two classes.

First.—Those affecting the income.

Second.—Those affecting the expenses.

Of the first class the most prominent is the decrease in losses from bad accounts resulting from service charges all passing under the eye of one manager and through the hands of one set of accountants. Railway business being on a strictly cash basis, is little affected. The income from lighting charges is first relieved from much of the drain of unpaid accounts, and second increased by the absence of the necessity for annoying many applicants for service with the demand for a deposit. The requiring of a deposit gives offense to nine out of ten applicants. It brings forcibly to their attention the fact that they are dealing with a monopoly and this is to the small customer the same as the red rag to a bull. He becomes immediately insulted because his honesty is doubted, and not infrequently ends with the statement: "Well, if I've got to put up that deposit to get it I don't think I want gas," and goes out of the office explaining to whoever happens to be in hearing that the only way for the down-trodden to obtain their rights is for the city to own and operate the gas plant.

The ability to grant concessions in one class of service to obtain

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additional custom in others is of great advantage to the management in dealing with large consumers. Many an important deal turns up some small pique or fancied wrong of the customer in his dealings with the public service corporations, and a small concession to this feeling will frequently accomplish more than a plain demonstration of saving in expense, or an improvement in facilities.

The consolidation of the influence of several corporations is another great advantage in obtaining business. The trade of the companies themselves in the different lines is a large factor in the town in which they are located, and when there is added to this the trade and influence of the companies' employees, the result is generally the most powerful concrete influence in the whole town.

Last of the first class of advantages is the absence under combined management of a whole host of small jealousies and conflicts between the managements of the different companies when they are separately operated. The common use of the street by all public service corporations is a frequent source of complications. The gas company wishes to repair a main which lies under one of the railway company's tracks. The gas people wish to stop waste that is going on and the railway does not want to lose the use of the track a single day. Even supposing that an agreement is reached without a lawsuit, there is still the trouble that the gas company will want to do the work in the summer, just the season when the railway can least afford to have its services interrupted. If the railway manager comes out on top (he usually does) the gas manager will feel somewhat put out, and sooner or later will either use his influence against some scheme of the railway, or what is equally undesirable, he fails to second it. Under the combined management this source of loss should disappear entirely. The money all goes to one account, and it is only a question of judgment and a few figures to determine which of the conflicting interests is the most important.

Turn now to the other side of the question, the economies of combination. There is quite, or nearly the same, amount of work to be done in the companies combined as in the same companies separate. The railway must run just as many cars, the electric light company must turn out just as many kw-hours. There are undoubtedly some few operations which are duplicated in the companies separated, such as inspecting and meter reading; the bulk of the work, however, is unaffected by the combination. It is there and must be done and paid for just as much as before. The economy does not lie then so much in the reduction of labor as in more fully using the full time and ability of each man employed.

First of all comes the concentration of responsibility. Each plant is just as much in need of a superintendent as ever, but where before that superintendent was either actually or in effect the business manager as well, his position now becomes a purely technical one. If the same man is retained after the combination as before, his time is now fully devoted to the technical side of his plant, and he should introduce economies there which he was too busy to see to before. If a new man is decided upon, technical ability alone is required, and this is much more readily obtained alone than combined with business experience.

Another class of labor with which we are all familiar and which can be reduced by combination is the "necessary" man, the man for whom we are constantly finding something to do so as to have him on hand for certain intermittent work.

The street departments of all public service corporations always contain some men of this class. The railway retains its track foreman, the lighting plant its line foreman, the gas company its tapper, and others of the same class. After combination much of this work can be thrown into one street department, thus reducing this class of permanent employees to a minimum.

The economy in the combination of the railway and lighting power houses is self-evident. The addition of the necessary machines for generating the railway power necessitates no increase in the watch force at the plant. The whole increase in running expense is the coal and repairs required for the railway machinery. By the use of double-end generators, in fact, the combination of the railway and lighting loads can be effected with a considerable economy in both first cost and coal consumption.

The peaks of the railway and lighting loads seldom if ever fall at the same time, so that the machines required for the peak on the railway can also serve to carry the lighting load over its peak.

In the office the amount of work can be somewhat reduced by having accounting systems of the different departments uniform and by uniting the accounts of all parties from whom material is purchased for the different departments in one purchase and sales ledger, ruled with a debit and credit column for each department. This book brings all the various small personal accounts outside of the service ledger together, and much reduces the clerical labor, especially in checking up and vouchering the small local bills. Still further economies in office labor can be accomplished by combining the bank account and voucher system, but these are so perfectly evident that it is useless to go into them in detail.

The saving in the amount of money locked up in stores is also quite a large item in the advantage of combination. It is self-evident that of such articles as are used in common by the various departments a much smaller surplus is necessary for the several departments run as one company than where each department is run by itself without reference to the others.

To sum up the foregoing, when companies, previously well managed, are combined, the advantages and economies lie not so much in broad, sweeping reductions as in the attention to the smaller details of the combined organizations. The advantages lie not so much in the line of actually reducing the whole amount of labor required to accomplish the combined result as in the economical division of that labor. The use of the whole instead of a portion of each employee's time and assignment of similar work in different departments to the same employee accounts for reduction in operating expense much more than the reduction of the actual amount of labor required for the production of the product.

Compressed Air Motors

BY H. D. COOKE

Compressed air for street railway operation is the subject assigned to me for treatment in this paper, and I find it difficult to place all the facts for an intelligent consideration of this subject before this convention in the twelve minutes allotted.

The question of liquid air was also coupled with this subject, but I do not deem it necessary to touch on this question more than to say that nothing has yet been accomplished in the manufacture of liquid air which will warrant its consideration as a factor in the operation of street railways at this time. The present method of its production is to start with compressed air at 2000 lbs. pressure, and by expanding many volumes of air at this pressure, thereby producing intense cold, to liquify a small volume of air. The only advantage which liquid air has is the small form in which it can be stored, 800 ft. being compressed into one, but, on the other hand, as in this form it is the ice of air, the additional cost of heat necessary to return it to ordinary air for use in cylinders, adds unnecessary expense. In other words, you cannot get out of a thing more than you put in it, and the expense in this case is prohibitive.

The subject-matter of our theme, therefore, will be confined to the latest and most improved compressed air cars now in actual service in three cities of the United States, which are started, kept running and stopped by compressed air. When it is considered that one of the earliest applications of air in railway service was its use for air brakes as a stopper of trains, it is passing strange that its use as a starter and operator of trains did not earlier occur to mechanical minds.

Space precludes any general review of the past history of air except to state that it was one of the earliest known of what may be termed the secondary forces or powers. Authentic records of the application of air are found among the writings of the Alexandrians, 300 years before Christ, and, later, water was used in connection with steam, but not much progress was made with either of these until the present century, during which such advances have been made in the manufacture of iron and steel, which have been used in the construction of engines, boilers, tubing, etc., as to make the use of steam the most important factor in modern life.

Although the application of compressed air to the propulsion of vehicles is of comparatively recent date, the fact that it is used in practically the same way as steam gives it the benefit of all that has been done in the way of the perfection of the steam engine. In fact, there are many instances where steam boilers have been charged with compressed air, and engines operated therefrom, and in one instance a locomotive was charged with compressed air and run about the railroad yards and used for switching, etc. For such purposes, however, specially designed machines are better.

Limited space precludes any but the most general review of this important subject, and certainly nothing is more important to street railways than the question of a power which can be economically applied to all conditions of service, and which is of so simple a character as to make its operation and maintenance equally economical. Recently, however, it has been given serious consideration, and all the claims made for it have been fulfilled. It has proved itself reliable, unchanging, and where it has once performed a service it has always, under the same conditions, con-

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tinued to perform that service. Unlike steam, compressed air does not have to be used as it is generated. It can be stored up, and is ready for use when needed. Compressed to any required degree, it will always return to its normal atmospheric density.

Briefly described, the construction and operation of an air car is as follows:

The most approved form of motor now in use in this country, and of which a number have just been constructed for the Metropolitan Street Railway Company, of New York, for its crosstown lines, consists of two small reciprocating engines underneath the car body, each connected directly to one pair of the car wheels, according to the most approved form of locomotive engineering practice. The pair of wheels so driven is connected by parallel connecting rods to the other pair of wheels, thus making all the wheels under the car drivers. The air, before passing into the cylinders of the engine, passes through a reheating tank of water, heated to an initial temperature of 300 degs. The reheating of the air before use returns to it all, or a very great portion of, the heat units which were taken from it during compression. To illustrate this, a test was made of a motor in Rome, N. Y. This motor, which carried 35 cu. ft. of storage, was run with cold air, until all the air was exhausted, and covered only 8 miles. Afterward, the same motor was run, using the reheating apparatus, and 15 miles were covered. The heating of the water in the tank is done by attaching a steam connection directly from the boilers which furnish steam to the compressors, to the reheating tank on the motor, and passing the live steam into the water.

In order that the minimum amount of difficulty might be experienced by the average motorman, a controller was devised, which, in appearance and operation, is very like an electric controller. An air brake is one of the features of these motors, and an ingenious contrivance in the way of a starter, is also controlled by the brake handle. The valve motion is exceedingly simple, and gives a range of cut-off of from 1-10th to 5/8ths of a stroke. There is no appreciable exhaust, and the operation of the motors is practically noiseless. The air brake used on these motors is operated from air stored on the car, and is absolutely noiseless, both in its application and release. Being operated by the same handle which starts the car, there is no danger of the motorman leaving his brake on and trying to start the car at the same time.

Cars of this type are in their sixteenth month of operation on the North Clark Street cable line in Chicago, doing the night or owl service on that line, and sometimes hauling two trail cars. During the severe winter weather and snow storms which prevailed in that city last winter the compressed air cars were the only ones to perform their regular schedule. Compressed air cars have been in use in France for several years, and also in Switzerland, and in some places in those countries are used to haul two and three trail cars, but the American motors are pronounced by both our own engineers, and engineers from other countries, to be far superior to those of European manufacture.

The storage tubes under the car are of mild steel, capable of withstanding a pressure of 5000 lbs. to the square inch. Bottles of this character are used, both in the power house and on the car; the initial pressure in the power house being about 2500 lbs., and on the cars about 2000 lbs., which pressure on the cars is, by means of a reducing valve, reduced down to about 150 lbs. to the square inch before going through the reheating tank, and thence passing into the cylinders. It will be seen, therefore, that there is an ample factor of safety allowed by the storage tubes, and all precautions which can be are provided. It is apparent that the farther the cars travel the greater the factor of safety becomes. The storage on the car is underneath the seats, or the car floor, and the cars, in appearance, resemble the standard Broadway, New York, cars, none of the storage or machinery being in sight, and no paying space being taken up by either.

We now come to the power house: Air compressors, driven by an economical stationary steam engine, or by water or other power, compress the air from atmospheric to 2500 lbs. pressure to the square inch, and as the air is compressed, it is stored in a battery of steel bottles of the character of those above mentioned. During compression, however, great heat is developed, and a system of water jacketing is used which reduces the temperature of the air to that of the surrounding atmosphere. By means of a special separator all the moisture contained in the air is separated from the air as it passes from the compressor to the storage, thus securing perfectly dry air. It is well known that expanding gas or air develops an exceedingly low temperature, but the use of the separator, removing all water from the air before storage, obviates freezing upon expansion, and the passing of the air through the hot water before use in the working cylinders restores to the air the heat units which were taken from it during compression, and also furnishes enough moisture in the form of steam to assist in lubricating the cylinders. The exhaust from the engine cylinders never falls below 70 degs.

In order to recharge the storage on the car it is only necessary to connect the storage in the power house with that on the car, and equalize the pressure between the two. This is usually done at the end of a run, and while the car is waiting, and takes about two minutes. In Chicago, however, this is done on the street, and while the car is on its route, and has never caused any delay or stoppage of the service, even though done while the air cars were running between cable trains.

During the last four years experimental and actual demonstration of air cars in the service have reasonably determined the following facts, viz.:

That the cars operated in Chicago during a period of six months consumed an average of 409 cu. ft. of free air per car mile, and that the cost of maintenance of these motors is much less than that of the ordinary steam engine, as there is no boiler to be cared for.

We have been furnished figures by the most responsible builders of air compressors in this country, estimating on a volume of 6800 cu. ft. of free air per minute, which should be sufficient to operate one hundred cars, which show that 2.8 cents will compress 1000 cu. ft. of free air to 2000 lbs. pressure. This estimate is approximate for local conditions, and coal is figured at $2.90 per ton for a twenty-four hours' service, taking 2 lbs. per hour for indicated horse power. This includes attendance of engineers, helpers, firemen and laborers, and also for oil and waste, and allows for 10 per cent per annum for depreciation.

It is believed that compressed air cars have a place in every large system already installed, whether cable or electric, either for performing night service where it is not advisable or economical to run a large plant for the operation of a small number of cars, or where feeder or crosstown lines are necessary, and the installation of the overhead or underground trolley would not be permitted.

In brief, the advantages of compressed air for the operation of street railways may be summed up as follows, viz.:

1. A system of independent motors, which, after receiving their charges, do not rely upon the power plant, and which will always finish their run, should anything happen to the power plant; which also do not need any special outdoor construction, either underground or overhead, with the attendant cost of maintenance.

2. Slow moving machinery, both in the power house and on the car, which is easily maintained.

3. Opportunity for charging cars, and storage in power house, during light hours, for use during the rush hours.

4. Spring-supported motors and load, doing away with excessive jarring and pounding on the track, and thus greatly prolonging the life of the roadbed, the life of the motors, and contributing to the easy riding of the cars.

5. Low first cost of plant; low cost of maintenance, and opportunity for making repairs and adjustment without stopping operation of cars.

6. Freedom from liability of delay in transit from snow, ice or sleet.

Storage Batteries in Railway Power Stations *

BY PROF. H. H. NORRIS, CORNELL UNIVERSITY

Within the past few years more attention has been given to the refinements of station operation than was possible at the time of the rapid change from horse and cable to electric traction. By the use of the many engineering devices now popular the coal consumption in stations supplying power to electric railway systems has been reduced to a very respectable figure, not greatly exceeding 4 lbs. of coal per output horse-power in first-class plants. This accomplishment is remarkable when the nature of a railway load is taken into account. This load fluctuates greatly in two ways: First, from instant to instant, especially in small roads, and also on account of the variable nature of the business during certain hours of the day. These fluctuations tend to prevent economical operation of engines, boilers and generators, while the "peaks" and the extremely light loads reduce the load factor of the station.

Careful selection of sizes of machinery tends greatly to economy, but there has long been felt a need for an automatic regulator of the load which should be economical and convenient. The storage battery has always been considered a theoretically ideal device for the purpose, but patent litigation and other difficulties interfered with its commercial development until quite recently.

FINANCIAL FEATURES

The financial features connected with the application of the storage battery to railway work form the determining factor in their use. There is no doubt, from an engineering standpoint, that

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they are a success. They have not been in use in this country in railway work for a long enough period to determine absolutely their depreciation, but apparently this does not amount to much more than that connected with moving machinery. The experience of a number of large users of the storage battery has been obtained, and during the short periods in which the batteries have been in use, practically no money has been spent in repairs. The oldest battery of which data is at hand, has been in use five years, but most of the batteries have been installed within two years. The depreciation which one of the largest manufacturers figure upon is from 2 per cent in the best managed stations to 8 per cent in small plants considerably overworked. Six per cent they consider to be a conservative figure under reasonable conditions.

The first cost of a battery is considerable, being, in average size plants, not far from $100 per kilowatt output when discharged in one hour. The same battery will have a much larger capacity when discharged more slowly. In order to obtain a general idea of the proportion of size of battery to capacity of station, data was obtained from a number of well known plants. Out of the station capacity of 43,560 kw the battery installed had a total capacity of 28,560 amperes for one hour, or an average capacity of two-thirds of an ampere hour per kilowatt output. Assuming a capacity of station of 1000 kw a battery of 666 amperes output for one hour would be chosen. The exact amount varies with the nature of the work demanded of it. For "peak" work a larger battery would be needed than merely for regulating work. If a battery of 270 cells were used, assuming an average pressure of two volts per cell, the cost of such a battery at the above figure would be about $35,950. At 6 per cent depreciation and 5 per cent interest, the annual cost of this battery would be about $3,955, exclusive of booster, attendance and building. The booster is necessary if a close regulation of voltage is desired, and the cost of such booster is between $50 and $150 per kw. If the booster produces a pressure of 50 volts its capacity is about 9.25 per cent that of the battery, so that its price in the above illustration would be somewhere between $1606 and $4818. Assuming depreciation on booster at 8 per cent and interest as before, the annual cost of booster would be between $21.20 and $63.60 per year, the exact amount depending on local conditions. Attendance usually involves no extra expense as the regular employees of a station are able to give the necessary amount of time without interfering with their other regular duties.

Cost of extra building is a purely local matter, and amounts to very little except in the case of large buildings, as some spare room is to be found about most stations. To offset the extra expenditure due to the use of the battery, there should be a considerable reduction of expenses in operating the boilers, engines and generators. This saving should result from the increased efficiency of the apparatus due to more effective loading; to reduced depreciation on machinery from the same cause; to the saving of wages through shutting down of plant during light loads; to the saving of copper in the lines when the batteries are installed in sub-stations, and other reasons following from these. The almost universal testimony is that the saving more than counterbalances the increased expense, and that, therefore, the battery is an economical adjunct to a railway power station.

ENGINEERING FEATURES

Viewed from the engineering standpoint, a storage battery serves a number of very useful purposes in a railway station or sub-station. First, by reducing the fluctuations of the load, thus allowing the machinery to be operated under more advantageous conditions. Second, by acting as an energy reservoir for the supply of excessive drafts of power, and thus permitting the installation of a smaller number of units than would be otherwise necessary. Third, by placing the batteries in sub-stations the pressure over the system can be made more uniform, for the battery will be charged when the draft of power is small, and discharged when this becomes excessive. Fourth, by drawing upon the battery at times of very light load the machinery can be often shut down and the load operated from the battery alone. This feature is especially applicable to small stations, when the night load is very light and where accidents to machinery often cause annoying shut-downs.

The use of an energy storage reservoir is common in many applications of mechanical laws. For example, in the steam engine the fly-wheel absorbs the energy supplied very irregularly from the piston. If the load on the engine be steady, the fly-wheel regularly absorbs energy when the piston pushes more strongly than is necessary, and gives out enough to supplement the effort of the piston when this falls below the amount required to overcome the resistance of the load. The pressure on the piston may vary from 100 lbs. per sq. in. at the beginning of the stroke down to 5 lbs. or 10 lbs. at the end. Through the medium of the fly-wheel this effect is averaged and may deliver a steady effort equivalent to a uniform pressure of, say, 40 lbs. per sq. in. on the piston. If it were not for the inertia of the moving parts, the engine would stop before the load reached the average value of the piston effort. Still more so is this true when the load also is irregular. Here, the fly-wheel acts as a buffer between the variations on both sides.

It is exactly in this way that a storage battery neutralizes the fluctuations in the current of a circuit when connected in parallel with it, for it absorbs energy and stores it in chemical form when the load is light, and restores energy to the circuit when the load is heavy.

It is in "peak" work even more than as a regulator that a storage battery demonstrates its utility. It is certainly uneconomical to install machinery which will operate for but a few hours each day. A heavy draft of current from a battery will not injure it materially, so that a small battery will carry a very heavy load for a short time. It does this at a reduced efficiency, but the loss in energy in the battery does not amount to as much as the saving effected. W. E. Harrington, general manager of the Camden Suburban Railway Company, of Camden, N. J., states that a reduced coal consumption of 23 per cent; an increased capacity of station of 300 amperes on account of a more economical load upon the engines; a material reduction in expense for repairs upon machinery, are some of the results of the installation of a battery in his plant. The capacity of the station is 1615 kw, and the battery has a capacity of 300 amperes per hour, somewhat below the average stated earlier.

John Murphy, general superintendent of United Traction Company, of Pittsburgh, Pa., reports curtailed operating expenses equivalent to 24 per cent of cost of battery.

The use of batteries in sub-stations, particularly where the distribution of power is accomplished by the use of alternating current at high pressure and rotary converters, results in very high economy. The rotary converter is loaded uniformly, so that its highest efficiency can be maintained, and thus an efficient supply of power is at hand directly where it can be used to the best advantage. Rotaries are used with great satisfaction in the Buffalo Railway Company, of Buffalo, N. Y.; the Rhode Island Suburban Railway Company, of Riverview, R. I., and many others. In the immense system of the Metropolitan Street Railway Company, of New York City, twenty-one 1000-kw rotaries will be used. W. A. Pearson, electrical engineer of this company, states, as the benefits due to the use of the battery in this connection, that it "decreases the load variations at the different stations, gives us reserve to fall back upon at times of heaviest loads, and allows us to shut down sub-stations for work on high-tension wires and on steam plants at hours of lightest loads."

The ability to shut down a station for even a few hours a day not only effects a saving in running expenses, but it allows time for repairs and inspection of machinery. It is better for the men, as it shortens the hours of labor, and it is better for the station. In addition to the matters already mentioned, the battery is of great assistance in enabling the generating units to be kept fully loaded, as the load increases and decreases. In fact, in very large stations this is one of the principal uses of the battery. It is the custom to install several generating sets and to start and stop them as the load demands. Without the battery the load on the different units would be fluctuating, but with the battery the latter furnishes part of the power until it is found economical to shut down a unit, and then it gives out power until the load has fallen to about one-half the capacity of the unit next to be shut down. The reverse of this is true with an increasing load. This point will be brought out more fully in the discussion of the Buffalo Railway plant.

A most important feature of storage battery installation is its use in line work. It is a well known fact that the average power carried by a line is very small in comparison with the occasional heavy demands: Thus, if a line be designed for a given drop with the average current, the drop with unusual drafts of current will be excessive, which naturally occurs when the pressure should be highest. To put enough copper into a line, especially when the latter is long, is impossible from a financial standpoint, so that a compromise has to be effected between excessive drop and financial economy. It is the emergency drop that has to be looked out for. Just here the storage battery is very effective. By locating it at some distance from the station the battery is charged rather uniformly from the line. When a heavy draft of current occurs, instead of an excessive drop in the line the battery furnishes most of the large current, and thus the drop is only the natural drop of the battery between charge and discharge. In one case the installation of a $10,000 battery was stated by the engineer to have saved $30,000 worth of copper. Although the depreciation in copper is less than that of the battery, it is not enough less to offset this saving. Still other uses of the battery

might be mentioned, but most of these follow as a consequence of the advantages described.

BATTERY OPERATION

The beneficial effects of a storage battery are largely dependent upon the treatment which the battery receives. The battery has two purposes; first, regulation, and second, preparation for emergency. In the first case the battery can be handled for economy much more easily than in the second. In anticipation of an emergency, such as a heavy peak in the load curve, or the possibility of a "shut-down," the engineer will naturally over-charge his battery in order to be sure that it contains the maximum possible quantity of energy. Overcharging necessarily involves a waste of energy, so that the battery will appear less efficient.

In regulating work the battery is most economical when it is about three-quarters fully charged. This is true for the following reasons:

In charging and discharging there are two main sources of loss of energy; first, the loss in ampere-hours due to overcharging, and second, to the loss in pressure, both in charging and discharging, and local action caused by the resistance of the battery and connections, and by local chemical action. The second loss is much greater when the battery is nearly fully charged; hence the desirability of keeping the charge below this amount. Three-quarters full is found to be about the best amount. These losses can be made a minimum by careful handling, as will be brought out in the illustration from the Buffalo plant.

THE BUFFALO PLANT

In order to illustrate the principles described in the first part of this paper, a well known and representative plant will be discussed in some detail, with a description of elaborate tests made upon it by students of Sibley College, Cornell University, during the past spring. The stations of the Buffalo Railway Company have been fully described in the "Engineering Literature," in which additional details can be found. The tests were made at the Niagara Street station, where power is obtained from a steam plant and from Niagara Falls. This station is now shut down and undergoing extensive alterations in order to utilize still more completely the Niagara Falls power, the experience with rotaries having been so eminently satisfactory.

The boiler equipment consisted of four 250-hp Babcock and Wilcox water-tube boilers, twelve 300-hp same make, and two 300-hp marine boilers. The supply of fuel was as nearly automatic as possible, as an electrically operated elevator took coal from the dump near the railway to a coal pocket of 2500 tons capacity immediately behind the station. A second conveyor, electrically operated, raised the coal to the top of the boiler room, where a horizontal conveyor carried it to a 5-ton hopper. A second movable hopper, of 1-ton capacity, distributed the coal to the Roney over-fed automatic mechanical stokers.

This portable hopper enables a very complete record of coal consumption to be kept, by recording the number of times which the hopper is emptied.

Removal of ashes was accomplished by running a hand-car in a tunnel below the hopper-shaped ash-pits and emptying the ash-pits about twice a day.

Feed-water is supplied either from the Niagara River, which is the normal arrangement, or from the city supply in emergencies. The water for the boilers is drawn from storage tanks of about 3400 gals. capacity each, through feed-water heaters. These tanks are supplied from the hot well of about 310-cu. ft. capacity. The water in the storage reservoirs is kept at about 50-lbs. pressure.

The engine equipment consisted of eleven engines, all two-cylinder cross-compounds, as follows: Two horizontal automatic Ball engines of 250 hp each. Nine vertical marine Lake Erie engines, three of 1000 hp each, and six of 500 hp each. To each of the three 1000-hp engines a ten-pole, 800-kw General Electric generator was directly coupled. To one of the Ball engines a 200-kw Edison bipolar machine was belted. Two generators of the same type were belted to three of the Lake Erie engines and 200-kw four-pole General Electric generators were belted to each of the other three engines.

A notable feature of the engine room was the rotary equipment. Four six-pole three-phase, 500-kw rotary convertors took alternating current from the secondaries of transformers at 350-volt pressure, three-phase. The primaries of these transformers are fed at 10,000-volt pressure from the Niagara Falls power plant. The rotaries convert the alternating current at 350 volts into a direct current at a pressure of about 550 volts.

The storage battery equipment of this station was a very large and complete one, having a capacity of 3000 amps. for one hour, and consisting of 272 cells of the "Chloride" type. As auxiliary to the battery a 70-volt booster, capable of passing 3000 amps. or more, was connected between the positive side of the circuit and the ground. The purpose of the booster was to force the battery to discharge when the load was heavy, and to force it to accept current when the load was light. This was accomplished by raising the battery voltage in the former case and lowering it in the latter.

The station was supplied with all necessary modern auxiliaries which go to increase the economy of operation of such plants.

RECORDS AND TESTS AT THE BUFFALO RAILWAY COMPANY'S PLANT

In the station just described very careful records of station performance were kept. These included readings at ten-minute intervals of voltage, total current output and generator-current output. Also, the daily coal consumption, number of boilers in use, wattmeter readings and weather conditions were recorded.

The conditions under which the plant operated were peculiar. A certain amount of power was purchased from the Niagara Falls Power Company to be used continuously. Also, the large number of cars constantly in operation made the load on the station remarkably uniform. These facts should be kept in mind in analyzing the results.

The charts plotted for the electrical readings, for the month of March, 1900, have been carefully studied for the purpose of this paper. On these charts a dotted line shows the total station output, and a solid line the generator output. The difference in the positions is due to the presence of the storage battery, which causes the dotted line to be above the solid at times and at other times below it. When the dotted is higher the battery is discharging, and vice versa. The area inclosed between the lines shows the amount of battery action, either charge or discharge, the inclosed area being exactly proportional to the energy transferred.

The charts show the following points very clearly:

1. The effect of the battery in straightening the generator load line is evident from a casual glance, the peaks being practically entirely carried by the battery.

2. The storage of energy for emergency use during light loads is shown by the large "charging areas" at these times. At night when the engines are all shut down and the load did not equal the capacity of the rotaries, the battery took up the surplus power. Similarly for the morning hours between the early peak and the noon hour.

3. The great assistance of the battery is adjusting the engines and generators to the changing load is brought out in a very interesting manner. As the load decreased the battery accepted more and more current from the generators, as shown by the battery ammeter. When the current had reached a point, fixed by previous experience, a generator was cut out. This reduced the generator capacity for the time below that required for the load. The battery then discharged until the load had fallen below the capacity of the generators. This continued until all of the generators had been cut out, and yet none had been run at inefficient loads.

By integration of the charge and discharge areas on the chart by means of a planimeter, the input and output of the battery in ampere-hours was obtained. From these measurements it was determined that during thirty-one days the battery received 189,369 ampere-hours, and gave out 164,036 ampere-hours, or a proportion of discharge to charge of 86.6 per cent. This is independent of some minor slight fluctuations too small to be noticed on the chart, but which affect the battery efficiency slightly. Assuming that the difference in pressure at the battery terminals varies by about 12 per cent between average charge and discharge, the efficiency of the battery for the work demanded of it in this case is about 75 per cent. This is lower than would be obtained for regulating work only, the peak or emergency work requiring overcharging with consequent loss of efficiency. In a case where the battery was used largely for regulating purposes with very small variation in voltage, over 90 per cent watt efficiency has been obtained.

4. From the coal records, the fact is deduced that less than 4 lbs. of coal are required for each hp-hour of electrical energy given to the line.

This record system is admirable, and gives data from which not only the performance of the station can be ascertained, but by studying which desirable improvements in equipment and methods of operation can be decided upon.

SIBLEY COLLEGE TESTS

Additional data for studying the operation of the plant under consideration can be obtained from a set of elaborate tests made during several days of March of this year.

The purpose of the tests was to determine:

1. The station economy as a whole.

2. To discover the effectiveness of the storage battery.

3. To determine the relative economy of the power from the engines and from the rotaries.

Incidentally the efficiencies of the various parts of the equipment were necessarily determined.

The standard methods were used throughout and no loss of any moment was allowed to go unmeasured. All instruments were carefully calibrated, and all readings were made continuously for twenty-four hours at very minute intervals. The error in the electrical measurements, as far as the instruments were concerned, was not more than one-half of one per cent, probably less. Particular interest in connection with the subject under discussion attaches to the battery measurements. A large Weston ammeter with plus and minus scale was used for the battery current readings. These were made at twenty second intervals for seventy-two consecutive hours without interruption.

The data resulting from the tests comprises the following:

Complete sets of data relating to all individual parts of the station under three conditions:

1. Normal, that is with generators, rotaries and batteries operating as usual.

2. Without rotaries, that is without Niagara power.

3. Without battery.

The information under these conditions is:

Complete boiler tests, including every detail and computation of boiler and grate efficiency.

Engine indicator diagrams and other measurements for determining engine output and efficiency.

Generator readings of current and pressure.

Battery readings of current and pressure at twenty second intervals.

The tests involved the employment of over eighty observers, and the computations required the labor of a number of men for several months.

The results of the tests are given in the following tables, taken from the thesis of Messrs. Burt and Macomber, and already printed in the *Sibley Journal of Engineering* for June, 1900, in connection with a paper by Profs. R. C. Carpenter and H. J. Ryan.

PARTIAL SUMMARY OF RESULTS OF TESTS

	Run 2	Run 3	Run 3
Pounds of steam per i. h. p. per hour auxiliaries included..	24.88	24.38	25.79
Water from and at 212 degs. in lbs. per e. h. p. hr.....	34.1	33.5	342.
Coal per i. h. p. per hour lbs.	3.53	3.31	3.64
Dry coal per e. h. p. hr. lbs..	4.23	4.04	4.17
Ave. mech. efficiency.....	84.1%	83.7%	84.2%
Engine i. h. p. hrs.....	69,900.	107,700.	53,250.
Generator output, hp-hours..	61,300.	92,600.	46,600.
Battery hp-hours—			
Charge	5,350.	6,100.	....
Discharge	1,950.	1,500.	....
Rotary output hp-hours.....	37,500.	....	31,100.
Total output e. h. p. without rotaries	59,900.	88,000.	46,000.

DISCUSSION OF RESULTS OF TESTS

The data resulting from the tests shows that more steam and more coal are consumed per indicated engine horse-power when the battery is not in operation than when it is. This is due to the increased efficiencies of the moving machinery. The summary shows that the efficiency is slightly less under normal conditions than when operating without the battery, but this is the average efficiency for the whole plant, some parts of which operated for a comparatively small number of hours per day.

The apparent battery efficiency is very low, due to a prolonged over-charging. It has been previously shown that the efficiency of the battery is not far from 75 per cent under normal conditions, and over-charged only to an amount necessary to secure a reserve for emergencies. Unfortunately the cells had been heavily over-charged just previous to the test, on account of some cells which had been short-circuited. Also, at the time of the tests a very heavy snow fall drew so heavily upon the resources of the station that the engineer evidently heavily over-charged in order to be ready for any possible emergency. This accounts for the low efficiency of the battery. The accompanying table shows a history of this over-charge during the days of the tests.

OVERCHARGE OF BATTERY, MARCH 1, 2 AND 3, 1900

Horse-power hours.		
In	Out	Gain
1,160.7	....	....
....	35.9	1,124.8
6.	....	1,130.
....	996.	134.8
2,155.7	....	2,290.5
....	.2	2,290.3
48.4	....	2,338.7
....	81.4	2,257.3
4.1	....	2,261.4
....	4.	2,257.4
12.2	....	2,269.6
....	3.2	2,266.4
9.6	....	2,276.
....	25.6	2,250.4
185.	....	2,335.4
....	361.1	1,968.3
4,984.2	....	6,952.5
....	1,093.5	5,859.
43.2	....	5,893.2
....	7.	5,886.2
32.6	....	5,918.8
....	26.6	5,892.2
208.8	....	6,101.
....	73.1	6,027.
1,624.1	....	7,652.
....	24.7	7,627.3
2.5	....	7,629.8
....	26.6	7,603.2
21.9	....	7,625.1
....	616.7	7,008.4
13.1	....	7,021.5
....	11.6	7,009.9
3,452.7	....	10,462.6
....	411.9	10,050.7
52.	....	10,102.7
....	34.2	10,068.5
2,146.3	....	12,214.8
....	340.9	11,873.9
395.4	....	12,269.5

The storage battery is not yet perfect, for there are disadvantages connected with its use. There is considerable variation in voltage; its first cost is high; some power must be wasted in the battery. To offset these facts, there is a decided advantage in steadying the load on generators, in keeping up the voltage when the battery is installed away from the station, in enabling the generators to be economically adjusted to the load-line, in wear and tear at the generator commutators on account of the steady load, and, most important of all, in the preparation for emergencies such as peaks in the load-line and possible temporary shut-downs. The remarkably rapid installation of storage batteries in railway stations, which has occurred within the last two or three years shows that the advantages enumerated are generally believed to more than compensate for the disadvantages.

Rochester & Sodus Bay Railway Company*

BY T. J. NICHOLL

At the risk of being called a bore, having a full knowledge of the many descriptions of new electric lines that have appeared from time to time in our railway journals (and which have almost become tiresome), I am going to venture upon your patience with a short description of a new line that has just been completed between the city of Rochester and Sodus Bay, N. Y. I do not know that there is anything particularly unique in its construction, nor that there are any details that may be valuable or even interesting to the convention; at the same time it may be that some points of good can be obtained that will be worthy of your consideration. At all events, the facts are given for what they are worth, and are a record of practical experience.

In 1898 my attention was first called to the necessity of an electric road connecting Rochester with Sodus Bay, between which is located probably the most prosperous country in the State of New York, devoted to agricultural and horticultural pursuits of great variety, the entire distance being 41 miles, and containing a population, including the city of Rochester, of nearly 200,000. This road reaches the famous Glen Haven resort, on Irondequoit Bay, and great Sodus Bay, which has long been noted for its beauty and popularity as a resort.

After many little meetings of a few gentlemen in our city, it was decided to incorporate, and accordingly we obtained a charter

*Paper read before the New York State Street Railway Association. Sept. 18-19, 1900.

on Aug. 13, 1898, after which we had to appear a number of times before the Railroad Commission of the State, and on the 24th of January, 1899, received from the Commission the required certificate, allowing us to proceed with the work. Then came the question of arranging for the money with which to build the road, which occupied our time until about July 1, 1899, when financial matters had been arranged and the real work of getting right of way, making permanent surveys, estimates, etc., began. The first sod was turned on Sept. 11, 1899, and the road was completed Aug. 22, 1900.

ALIGNMENT AND GRADIENTS

The line of the road begins at an intersection with East Main Street in the city of Rochester, 1 9/10 miles east of the center of the city, called the "Four Corners"; thence to Glen Haven, in a northeasterly direction; thence around the end of Irondequoit Bay, crossing the inlets to the same upon what is known as the Float Bridge, and up the Dugway Hill to the west end of the noted Ridge Road; thence along the Ridge Road to the town of Sodus; thence, paralleling the Rome, Watertown & Ogdensburg Railroad, to Wallington, where it passes under the Rome, Watertown & Ogdensburg Railroad in the ravine of Salmon Creek; thence, paralleling the Northern Central Railroad, to the village of Sodus Point on Sodus Bay, being a distance of 39 1/10 miles from the East Main Street station.

The heaviest grade is on the Dugway Hill, where it reaches, in one or two places for short distances, 5 per cent, compensated for curves. There are many other places along the line where the grades are as high as 3 per cent and 4 per cent for short distances, and the shortest curves are of 100-ft. radius. There is level about 70 per cent of the line, and tangents about the same per cent. All of the worst curvatures and gradients are made at the crossing of the Irondequoit Bay, in getting down to and out of the same.

RIGHT OF WAY

About 13 miles of the 39 miles is through private right of way, obtained by purchase and condemnation. The balance is along highways, where we first obtained the consent of the municipalities and afterward of the abutting property owners, and in this respect it may be proper to say that we had any quantity of trouble. The people, feeling that we were compelled to use the roadway, put up all sorts of obstructions and claims for damages, in the way of spoiling trees, crossings, appearance, etc., but I am glad to say that such people were much in the minority. There were sufficient of them, however, to make it very interesting at times. A whole chapter could be written upon this subject alone.

TRACK CONSTRUCTION

Track was built of 60-lb. T rail in the country, and 60-lb. girder rail through the villages, all in 60-ft. lengths; angle plates 24 ins. long, with four bolts 3¾ ins. x ¾ in., and of such a shape as to permit of electric bonding under the same. The rails were laid on oak, chestnut and cedar ties, using the cedar ties, as much as possible, on straight track and oak on curves. At the time the road was built it was quite difficult to get a sufficient number of standard ties, but generally we used ties 6 ins. x 8 ins. x 8 ft. long, and always placed 2-ft. centers. The electrical bonding used was generally a 0000 copper bond about 8 ins. in length, bent and flexible so as to provide for the movement of joint and expansion. In addition to this the track is cross-bonded once in every rail with a 0000 copper wire bond, using a brass clip that is threaded into the web of the rail. The track was ballasted, in many cases, with the local material and filled up well to the top of the rail, but generally with gravel, which had to be hauled some considerable distance from the various points along the line, for which we had to pay all the way from 8 cents to 16 cents per load. On the hills, and where private right of way was purchased, a regular roadway was formed, 12 ft. wide, with banks 12 ft. wide on top and cuttings 16 ft. in the bottom, with ditches, and on such work the track was ballasted with the ordinary material, which was generally sand, and filled only to about 2 ins. above the center of the tie. Along the roadway the general plan was to plow and scrape out to a depth of from 6 ins. to 18 ins., as occasion might require, so as to bring the top of the rail about even with the adjoining highway, and of course in every instance of this kind the track is filled in solid with gravel or equally good material. The bridging is generally of the standard steam railroad, trestle and pile bent style, using both wooden guard rails on the outside of the rails, and rail guard rails on the inside of same, bent inward at the end of the bridges in case of derailment. Along the highways we simply extended the kind of structure used on the highway, as it was needed, which was either of vitrified pipe, brick or stone arches, as the case might be.

The crossing under the Rome, Watertown & Ogdensburg Railroad at Wallington is made through a high embankment, which is now being made by that company, held in position by heavy retaining walls, the Rome, Watertown & Ogdensburg Railroad crossing the same on a solid floor of steel I-beams. The cost of this structure was in the neighborhood of $7,500, and of course was paid for entirely by the electric line, and upon the consent of the Railroad Commission.

In the country the track is generally laid, where not on private right of way, on the side of the road, crossing the same from one side to the other wherever it seemed best and easiest to get the consent of the abutting property owners. Through the villages of West Webster, Webster, Union Hill, Ontario Center, Ontario, Williamson, East Williamson, Sodus and Sodus Point, where girder rail is used, the track is generally in the center of the street.

The road is single-tracked throughout, except that in every mile a turnout is provided, about 300 ft. between frogs, one or two being lengthened out a distance of nearly half a mile. Spring frogs and split switches are used, the switches being kept locked to the straight track, except at the regular meeting points of trains, where they are kept locked so as to pass to the right. The sidings are all numbered with signs easily seen by trainmen, and the approach to a switch is indicated by stripes of white and black painted upon the trolley poles, beginning six poles from the switch, which has three white and two black stripes. The fourth pole from the switch has two white and one black stripe, and the second pole from the switch has one white stripe. These stripes are made 8 ins. broad and 1 ft. long around the pole, showing toward the approaching car.

Road and farm crossings were all planked with 3-in. oak plank, except in some cases, where rails were laid inside, and the space filled in between with cinders or gravel, and we find this practice particularly good where we cross the highway, as the inside rail forms a guard rail. All curves of less than 500-ft. radius have guard rails on the inside of curve.

OVERHEAD CONSTRUCTION

Eight-inch top, properly weathered and painted, 30-ft. to 40-ft. poles were used, set 6 ft. in the ground. Generally the bracket form of construction was used, composed of steel pipe and heavy wire bacing from the top, upon which is hung, on a separate cable, the trolley ears holding the trolley wire. There are two 00 figure-8 trolley wires running the entire length of the road, with no switches thereon except two car houses. Curve poles are all stayed back with cables or knee braces, and all poles are numbered. The trolley poles carry feed and telephone wires, in addition to the trolley wire, and are placed 110 ft. apart. The high potential line, whereon is carried the 10,000-volt current, runs across the country, as much as possible along the highways, separate and entirely distinct from the trolley system, and runs only from the generating station to the sub-stations. This line is built with 8-in. top, 30-ft. to 40-ft. poles, as the case may require, placed 6 ft. in the ground. One high potential wire is carried on the top and the two others on 3-ft. cross-arms, placed 2 ft. below the top, so as to make the three wires not nearer than 18 ins. from each other. The insulators used are porcelain, triple petticoated, placed on iron pins surrounded by a porcelain tube, all angles being double cross-armed, with strain insulators inclosed in suitable housing to protect them from the wire. The strain insulators are provided with turnbuckles for tightening or loosening the line. These poles are also numbered, and the line patrolled daily, trouble, if any, being reported so that it may be remedied at nighttime.

POWER

The main generating station is located on Irondequoit Bay, 5 miles from the western terminus of the road, so located on account of fuel and water and the heaviest grades. The steam plant is composed of two 500-hp horizontal Corliss engines, cross-compound, supplied with steam by four 250-hp Taylor & Altman water-tube boilers. The electrical generating equipment is contained in the main power house and two sub-stations. At the Irondequoit Bay power house there are two direct-connected, three-phase, alternating current generators, of 300-kw capacity each, generating current at 380 volts, 25 cycles frequency, which is transformed by six 100 kw static transformers that step-up the current from 380 volts to 10,000 volts. There is also in the main station one 250-kw rotary converter, that converts the 380-volt alternating current into 600-volt direct current, for immediate distribution to the trolley feeders supplying the western section of the road. The static transformers are grouped into two banks of three transformers each, deriving their current from the main bus-bars at 380 volts and supplying the current to the high potential bus-bars at 10,000 volts.

The switchboard arrangements do not differ materially from the ordinary arrangement. The high potential distributing devices,

however, are of vastly different construction. The switches, circuit breakers and lightning arresters are all located on a balcony above the main switchboard, to obviate any possibility of contact with the current while operating the switchboard. All of the 10,000-volt current switches are inclosed in fireproof cases filled with oil, so that they may be operated while "alive" without danger. The circuit breakers are of a special type, arranged to break the current through a fusible shunt inclosed in explosion tubes located behind the switchboard. The manipulation of all these devices is done by a system of levers from below the balcony, excepting the tripping mechanism of the circuit breakers, which is operated by primary batteries. The tripping mechanism of the breakers does not operate by direct influence of the high potential current, but is controlled by limit relays, that derive their current from transformers connected to main transmission line, the object being to protect the transforming and generating units from injury caused by prolonged or excessive overload or short circuit in the transmission line. The retarding of the tripping device is accomplished by a clockwork mechanism that trips the breakers should the excessive rush of current extend beyond the time limit to which the relays are set.

A ground detector is also used on the high potential line, which indicates not only the ground, but also the particular wire on which the trouble has occurred. As stated before, the transmission line consists of three No. 1 bare copper wires, placed 18 ins. from each other, and forming an equilateral triangle, the object being to minimize the inductive effect of the line so far as possible, as well as the mechanical balance.

In each of the two sub-stations, which are practically 12 miles and 24 miles respectively from the main power station, there is a single bank of three step-down transformers, provided with a special high potential switchboard, and one 250-kw rotary converter, with its accompanying panel, essentially the same as the one used in the main power house.

The transformers, both in the main power house and at the sub-stations, are located over a waterproof pit, so as to afford an air space for ventilating purposes, and are supplied with air by a fan, driven by an electric motor, serving, also, to keep the transformers clear from dust.

The direct distributing current to the trolley is cut into six divisions, two divisions being supplied by the main power station and four by the sub-stations. Circuit breakers are placed midway between the power station and the first sub-station; also between first and second sub-stations, so that any one of the six divisions of the line may be operated independently of the others. The feeder used in all cases is 0000, running for a distance of about 3 miles in either direction from the main power house and sub-stations, except at the extreme east and west ends, where the feed wire is continued to a distance of 5 miles, leaving 17 miles which is fed directly through the double trolley.

BUILDINGS

The power house is built of brick, with slate roof, in the most economical form, with space provided for increasing the power equipment 100 per cent. The sub-stations are built of stone, and at one end of the car house of the same material, with roofs covered with gravel. Each of these outside car houses are large enough to take care of four 45-ft. cars. There is also a car house at the Rochester end of the line, built of brick with gravel roof, with all necessary pits, machinery, etc., for repairs. This house will accommodate sixteen of the 45-ft. cars. There will be, although not erected yet, suitable hand-car and tool houses along the line, for the accommodation of trackmen, inspectors, etc., which will be built of wood.

EQUIPMENT

The rolling stock consists of eight combination cars, 45 ft. long, with 10-ft. baggage and express compartment at one end.

Six passenger cars, 45 ft. long, with smoking compartment at one end, entered directly from the vestibule.

Four 45-ft. combination cars, with 20-ft. baggage and express compartment.

All of the above are equipped with either four G. E.-57 motors or four G. E.-1000 motors, as the service seems to require, mounted on Taylor extra heavy, radial trucks, 33-in. wheels, ¾-in. flange and a 2½-in. tread. All of the G. E.-57 motor cars are provided with Sterling hand brakes and Providence fenders. In addition to the above we have four single truck, 26-ft. motor cars and six 26-ft. trailers, work car, two coal cars and two double-fanned Ruggles' snow plows, which we are at present building.

In round numbers the cost of the road and equipment has been about as follows:

Track, line, right of way, etc.	$453,000
Power and buildings	134,000
Car equipment	115,000
Organization expenses	20,000
Total	$722,000

OPERATION

The road is now operated with one train each hour each way, from 6 o'clock in the morning until 9 o'clock at night, and upon regular steam railroad rules and practice, orders being given by repeated telephonic messages, the telephone line being owned by the company.

For the purpose of collecting fares the line is divided into thirteen fare limits of 5 cents each, which is collected at one time, and the passenger is given a check to cover the length of his journey, but is rung up as each fare limit is reached on the register. We carry bicycles for an additional 10-cent fare any distance. We also carry baggage and express, under a properly arranged tariff. Our large combination cars are used for the carriage of the regular freight, which is operated upon practically the same principles as steam railroads, using the official classification, except that we limit the classification to four classes instead of six. All our freight trains start and stop at the intersection of East Main Street in Rochester. Other trains run, under a traffic arrangement with the Rochester Railway, to the Four Corners. The running time from the center of Rochester to Sodus Point is about two hours and fifty minutes, in which distance there is an average of fifty stops made. The stopping places are all—or will be—marked by properly enameled "Car-Stop-Here" signs, also fare limits, and in all these cases poles are painted white, so that the motorman may see them quickly, and are spaced from 1000 ft. to half a mile apart, at points where they will accommodate the most people, except in the villages, where we stop at all street crossings.

We have regular agents for the billing of freight and express at all of the villages along the line and in Rochester, who are under the supervision of a general agent, and are paid by commission. These agencies are designated by regular "agency signs," and at these points waiting-rooms are provided where necessary.

I trust that I have not wearied you with this description, which is necessarily much longer than I expected. I thank you for your attention.

Precision in Steam Power Making

BY A. S. MANN,
Of the Engineering Department, Metropolitan Street Railway Company

It is usually possible to make the steam machinery of a power station show a very high efficiency for a short time; so high indeed that the results, if not questioned, are at least given little attention because they are so far above average results that it is at once presumed that all the conditions then obtaining are so far from the usual state of things that it is impossible to operate machinery in that way. The following observations have been made to show the nature of the difference.

A large engine can run for an hour on 11 lbs. of steam per hp. Boilers of a good type can be made to evaporate 11 lbs. of water per pound of coal, actual conditions, when burning good coal. Then that makes 1 lb. of coal per hp-hour. The monthly record of a plant will show about 2 lbs. of coal per hp-hour. Where does the extra pound go?

Most running engineers know that a plant can not run on test conditions One engine can go that way for a few days, but that is all, and boilers will not keep up to the mark for more than four days; they fall off a good deal. Leaks will come in blow-off valves and brickwork will crack. A fire will not keep itself precisely 8 ins. thick forever, and surplus air will get through with the furnace gases. Then the load varies so. Thirty boilers must be kept ready for heavy loads and at times there is not a good load for ten. If attention is given to draft gages and flue thermometers, the heat in the gases when they pass away is known, but fire room men are not accustomed to hundredths of an inch while sixteenths give one result one day and a different one the next. The engineer runs his place in accordance with his judgment. He does what is most expedient. He takes indicator cards regularly every week, marks them and files them away; keeps his daily log and divides coal by kilowatts. Sometimes the results are low, sometimes they are a little high; but the average is fair, and of course the great thing is to keep running.

The great part of that pound of coal is lost in the fire room, and it can be recovered by making test conditions perpetual. The fire room is an enormous laboratory, manufacturing furnace for gas and ash, and the qualities of these products must be known always. The quality of the raw material, coal, must be known always. A fire making a gas with 15 per cent of oxygen looks fully as good as one with 5 per cent only. The excess oxygen carries a larger volume of excess nitrogen in with it, which is heated to flue gas temperature. The perfect product is nitrogen and carbonic acid gas, with a little sulphur dioxide, and a perfect fire makes a perfect product, and is of proper thickness. This fire thickness and the draft necessary to keep the boiler at its determined capacity will give a gas temperature which is most favorable; it may be high or it may be low. If the draft is kept at that point precisely, and the gas temperature goes up, the tubes are becoming dirty and should be cleaned, even if they are blown out every day. With the proper fire thickness and draft, the flue gas analysis will tell nothing about clean tubes.

The fireman who makes an ash with 30 per cent carbon in it, keeps steam just as well as does the man who makes 15 per cent carbon in his. The difference does not appear till the ash samples are burned down, and results weighed out on the analytical balance. When this is done and the fireman is told of it he will keep watch of the quality of the coal. He sights a bad lot ahead and speaks of the possible injury to his record. He stops talking about his judgment and what he did for the navy and hunts up a better way of making ash.

The coal man sends good coal when he finds his stuff is passing through analysis before he is paid. He can face an opinion with one of his own till he finds he is facing figures. British Thermal Units are what he has for sale, and are what he should be paid for.

The indicator measures pressure in a steam cylinder as it varies from point to point. That is all it is good for. If the right pressures are not there at the right time, steam is going somewhere; something is leaking; valves and piston are not tight when they should be. If the diagrams are measured this will be discovered. It will not be discovered if they are simply looked at and set down as good cards because the line is sharp and black. The eye will not detect leaks unless it is pretty well trained. Then compression can be taken off till the parts are just balanced. This requires more accurate measurement. If there is a knock in the engine somewhere, then it must be removed by local applications. Total horse-power and not indicated horse-power is what takes the steam, and things must be set by measurement. Leaky blown down valves and cylinder drips must be made tight, even if they are ground and scraped continually. The water passing a slightly leaky valve should be measured, and the amount charged out to leaks. The monthly total will tell whether it will pay to keep men fitting up valves. It is ten times what would be expected.

Measurements of precision are what will keep a plant running under test conditions. They reduce operation to mathematical certainty, and the errors of what is known as best judgment, and which varies 10 per cent, are removed from the problem. There is no room for guesses or about rights. They will enable an engineer to form a correct theory; a theory which takes account of all the facts; a theory with which perfect practice will agree. Every engineer of experience has a theory, but it is usually based on a lot of conflicting facts which he cannot reconcile, and so he has nothing to which he can fit the laws of practice. There is no guiding line for practice, everything is a compromise, sometimes fair, sometimes not. Precision is wanting, nothing is measured and accurately allowed for.

Every point in the travel of coal and furnace gas to the chimney; every point of steam and its travel to the condenser; every point of feed water and its travel to the boiler must be measured, located precisely. Then there is a working chart which tells of loss and gain, and which reduces the business of ash and furnace gas making to an exact science.

The Accountants' Convention at Kansas City

The programme of the convention at Kansas City of the Street Railway Accountants' Association of America has just been published, and shows that a most interesting meeting may be expected. In addition to the papers and reports to be presented a very important addition has been made to the collection of blanks, thus the interest aroused at Chicago will be continued this year. An examination of this exhibit gives an understanding of the part taken by blanks and forms in the construction and operation of the properties, an understanding necessary to the successful financial, operating or accounting officer.

As required by the by-laws, formal notice has been given that a change is proposed in Article VII. of the by-laws. This change will undoubtedly be the subject of earnest discussion.

Following the plan of the third annual convention, the programme provides for three half-day sessions allowing the whole fourth day for examination of the exhibits. This includes the exhibition of blanks which will be open the whole day.

The programme, in detail, is given below:

MONDAY, OCT. 15, 1900

7:30 p. m. Meeting of the Executive Committee at the Midland Hotel.

TUESDAY, OCT. 16, 1900

10 a. m. At the convention hall.
Address of Welcome.
Annual Address of the President.
Annual Report of the Executive Committee.
Annual Report of the Secretary and Treasurer.
Regular business routine.
Paper: What does the General Manager want to know from the Accounting Department? By C. D. Wyman, Boston, Mass. (lately general manager New Orleans City Railway Company.)
Report of Standing Committee: On a Standard System of Street Railway Accounting. Chairman C. N. Duffy, auditor Chicago City Railway Company, Chicago, Ill.

WEDNESDAY, OCT. 17, 1900

10 a. m. Convention Hall.
Paper: The Routine of a Street Railway, Electric and Gas Lighting Company. By C. O. Simpson, auditor Augusta Railway & Electric Company, Augusta, Ga.
Report of Committee: Is a Standard Unit of Comparison Practicable? Chairman H. C. Mackay, comptroller Milwaukee Electric Railway & Light Company, Milwaukee, Wis.
Paper: Departmental Accounts. By H. L. Wilson, auditor Boston Elevated Railway Company, Boston, Mass.

THURSDAY, OCT. 18, 1900

10 a. m. Convention Hall.
Paper: Material and Supply Accounts. By W. M. Barnaby, accountant Brooklyn Rapid Transit Company, Brooklyn, N. Y.
Informal Discussion upon any subject in Street Railway Accounting. (This is to be in every sense informal.)
Report of Convention Committees.
Election and Installation of Officers.
Adjournment.

The headquarters of this association will be at the Midland Hotel. Other hotels are the Savoy, Coates and Baltimore, all near the Convention building.

The usual one and one-third rates have been made by the railways upon the certificate plan.

Annual Meeting of the Union Traction of Philadelphia

The annual meeting of the stockholders of the Union Traction Company, of Philadelphia, was held Sept. 19. Nothing of very great importance transpired at the meeting. Directors were elected as follows: Thomas Dolan, William L. Elkins, Alexander M. Fox, John B. Parsons, William H. Shelmerdine, Alfred Smith, J. J. Sullivan, P. A. B. Widener, George D. Widener, George W. Elkins, Alexander Balfour and Charles O. Kruger, vice James McManes, deceased. The report set forth the assets of the company at $15,583,046, with liabilities at $15,583,046. The operating report as compared with last year shows:

	1900	1899
Gross receipts	$11,793,858	$12,996,291
Operating expenses	4,793,366	5,624,898
Earnings from operation	$7,000,492	$7,371,393
Receipts from other sources	242,409	253,528
Net income	$7,242,901	$7,624,921
Fixed charges	6,625,827	6,686,900
Net earnings	$617,074	$938,021

The increase in the operating expenses is accounted for in the report by "the advance in the cost of all supplies and by the increase in wages."

The balance sheet of the company, dated June 30, shows:

ASSETS

Cash	$216,582
Cash in agent's hands	20,000
Fire insurance fund	242,995
Advances to leased lines	5,556,839
Supplies	277,285
Construction and equipment	3,277,232
Real estate	398,586
Accounts receivable	36,518
Stocks and bonds	5,516,758
Franchise account	90,248
Total	$15,583,046

LIABILITIES

Capital stock	$10,499,912
Increase fire insurance fund	13,305
Mortgage account	.....
Accounts payable	140,701
Equipment leased lines	.....
Accrued maintenance account	274,255
Charges not due	1,331,693
Open accounts, leased lines	1,731,473
Due underlying companies	231,215
Due leased lines	.....
Accrued interest	.....
Trustees' accounts	176
Loans	.....
Profit and loss	1,360,313
Total	$15,583,046

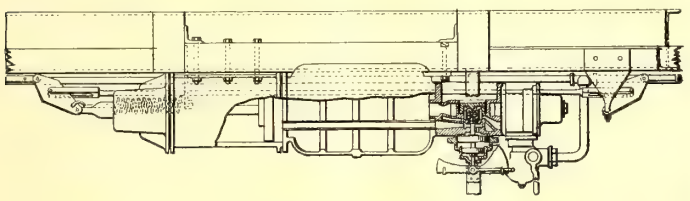
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

STREET RAILWAY PATENTS ISSUED SEPT. 18, 1900

657,962. Car; C. Roehr, Bucyrus, Ohio. App. filed Nov. 1, 1899. Relates to means for changing a closed car into an open one, there being a series of side posts provided with parallel vertical grooves in which three panels are adapted to slide independently of each other, the middle section being composed largely of glass.

658,031. Railway Car; W. T. Van Dorn, Chicago, Ill. App. filed Nov. 4, 1899. The car axle is extended beyond the journal and carries an anti-friction roller, which slides in contact with the under surface of a rail arranged parallel with the track. The object is to prevent the derailing of the car.



PATENT NO. 658,256

658,131. Metallic Railroad Tie; S. F. Swanson, Pueblo, Col. App. filed March 23, 1900. Structural details.

658,227. Car Bolster; H. C. Williamson and H. Pries, Michigan City, Ind. App. filed Feb. 26, 1900. Comprises tension members and compression members extending parallel through their middle section and converging at their ends, and Z-shaped struts extending from end to end of the parallel portion of the first named members, and having their flanges secured thereto.

658,256. Regulator for Atmospheric Car Brakes; J. Georgoff, St. Petersburg, Russia. App. filed March 29, 1900. Consists in having in the passages from the three-way valve to the brake cylinder a check valve that can be acted upon by a pair of differential pistons, so that upon a certain maximum pressure being attained in the brake cylinder this valve will operate and restrict or close the passage to the brake cylinder and prevent any greater braking force from being exerted.

658,326. Car Brake; F. Theilengerdes, Memphis, Tenn. App. filed June 8, 1900. Comprises an annular friction clutch member fixed to the axle and a co-acting annual member supported by gimbal rings, whereby automatic universal adjustment of its frictional face is permitted, and devices for forcing the two members together.

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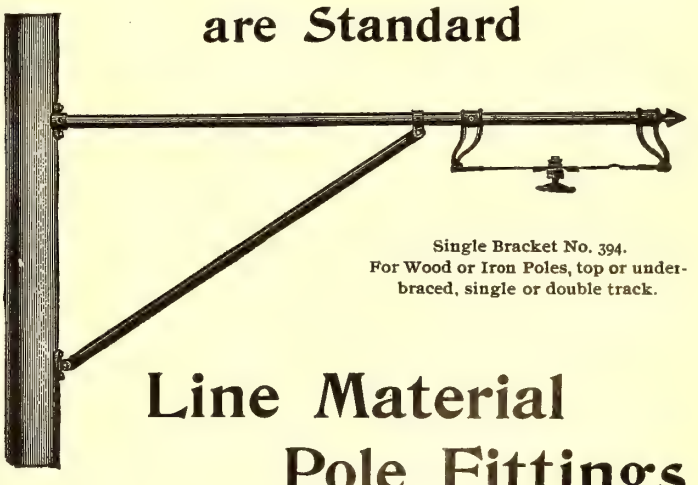

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PERSONAL MENTION

MR. OTTO A. STURZINGER has resigned as assistant superintendent of the Sandusky, Bellevue, Monroeville & Norwalk Electric Railway Company.

MR. THOMAS R. COLEIN, an attaché of the United Railways & Electric Company, of Baltimore, began his forty-first year of continuous service as a railway employee in Baltimore, on Sept. 16.

MR. J. D. PARKER has resigned as general manager of the Sandusky, Bellevue, Monroeville & Norwalk Electric Railway Company, of Norwalk, Ohio, and Mr. E. Adams, of Toledo, has been elected as his successor.

MR. MARTYN WELLS, resident manager of the Calcutta Tramways Company, Ltd., of Calcutta, India, is in this country for a short time inspecting the electric roads and studying American practice. Mr. Wells will return to London on Oct. 3 .

MR. WILLIAM A. HOUSE, manager of the United Railways & Electric Company, of Baltimore, Md., has just returned to that city, after a pleasant vacation trip. During his trip Mr. House inspected several of the Eastern street railway systems, including the New York system.

MR. JOHN NEVINS DODD, electrical engineer for the English Electrical Manufacturing Company, of London, England, was married to Miss Flora Melovidoff Elliot, of Lakewood, at Cleveland, Ohio, on Sept. 19. Mr. Dodd was for several years connected with the Walker Company.

MR. ISRAEL A. KELSEY, until recently general manager of the Winchester Avenue Railroad Company, of New Haven, Conn., and who was also interested in several electric railway companies in Massachusetts and Rhode Island, died at his home in West Haven, on Oct. 17, aged forty-one. He is survived by a widow and three children.

NEWS NOTES

BIRMINGHAM, ALA.—The Birmingham Railway & Electric Company, which now controls all the local street car lines, has secured a blanket franchise from the City Council. Heretofore each line has been operated under a distinct grant. In return for the new grant the company agrees to give universal transfers after two years. The company has placed its Fifteenth Street line in operation.

LOS ANGELES, CAL.—The Los Angeles Traction Company has withdrawn from the contest for street railway franchises here. This action was taken because it became apparent that the City Council would not recede from its position demanding an amendment to the State law before granting additional franchises.

NEW HAVEN, CONN.—It is stated that the United Gas Improvement Company, of New York and Philadelphia, will make application at next session of the Legislature for permission to establish an electric light plant in Bridgeport. It is said that the ultimate purpose of the company is to construct a dam on the Naugatuck River and build an electric plant at that point capable of operating electric roads and lighting cities and factories for 40 miles in any direction. Ultimately the whole of the Naugatuck Valley will be lighted and power furnished from one central power house.

LAPORTE, IND.—A special election will be held here Oct. 10, to vote on the proposition to appropriate $20,000 to aid in the construction of the projected electric railway to extend from Angolia, this State, across the Michigan line, with Coldwater as the terminal point.

INDIANAPOLIS, IND.—The new generator and 2500-hp engine of the Indianapolis Street Railway Company have been tested, and are now in operation. The company has built thirty new winter cars, repaired and remodeled sixty others, and will put 150 cars in service this winter.

BANGOR, MAINE.—The Railroad Commissioners have commenced their second annual examination of the railways in the State. They have examined the Bangor & Aroostook Railroad, and will examine the Portland & Cape Elizabeth portion of the Portland Railroad, Portland & Yarmouth Electric Railway, Brighton & Saco Railroad and the Grand Trunk Railroad.

WOBURN, MASS.—A car of the Woburn & Reading Street Railway jumped the switch at the turnout on Washington Street, Sept. 11, and, after running about 30 ft., it turned almost at right angles with the track and brought up against a guy wire post with considerable force. There were eight or nine passengers aboard, two of whom were injured.

WORCESTER, MASS.—The Worcester & Suburban Street Railway Company and the Worcester Consolidated Street Railway Company have reached an agreement, and will grant transfers between the two systems in the near future. They have also agreed upon the operation of cars over each other's tracks within the city.

BOSTON, MASS.—The Railroad Commissioners have an order approving the use of an electric system of motive power by the West End Street Railway on Cross Street, Malden. In doing this the board declines to assume juris-

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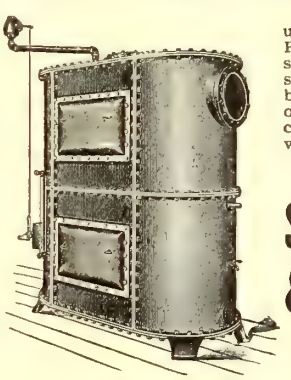

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STREET RAILWAY JOURNAL,
120 Liberty St., New York.

STREET RAILWAY JOURNAL

WEEKLY NEWS ISSUE

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY PUBLISHING CO.
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Our Convention Issue

Owing to the size of our monthly October issue and the additional labor in preparing and printing it, we have decided to date the magazine number this month on the second Saturday in October, instead of the first Saturday, as is our usual custom. The present number is therefore of the small weekly size, while the large number will be issued next week.

The Johnsons' English Enterprises

A special dispatch from Detroit quotes John G. Honecker, who has been the representative of the Johnsons in England for the past seven months, as authority for the statement that $1,000,000 will probably be spent by them in the construction of electric railways in England. The principal lines projected are those to connect with the Manchester & Liverpool Electric Railway. The latter is to be a high-speed line, with no stop between Manchester and Liverpool, and the Johnson lines will act as feeders, extending into the suburbs.

Compressed Air Cars in Rome

Rome, N. Y., has the distinction of being the first city in the United States to have a street car system operated wholly by compressed air. The compressed air cars were placed in operation Sept. 22, and the first car was run at 11 a. m. Robert Hardie, of the Compressed Air Company, of New York, was in charge of the car. The Mayor, officers of the company and a number of special guests were on the car. The trial trip was a very successful one, and the system has been pronounced a success. A detailed description of the system of the Compressed Air Company will be found in the STREET RAILWAY JOURNAL for Aug. 4, 1900.

From Boston to New York by Trolley

Robert H. Derrah, of Boston, the originator of Boston to New York by trolley, and a party of twenty-three persons left Boston for New York at 8:45 a. m., Sept. 24, intending to make the entire trip by trolley so far as practicable. The route, as mapped out, lay through Newton, Natick, South Framingham, Marlborough, Worcester, Springfield, Hartford, New Britain, Meriden, New Haven, Bridgeport, Norwalk and Stamford. Dinner was taken at Worcester Sept. 24. The party stopped over night at Springfield. On Sept. 25 the tourists left Springfield at 8 o'clock a. m., and took dinner at New Britain. They passed the night at New Haven, which was left the following morning at 8 a. m. They then journeyed to Stamford, where dinner was taken. The party arrived in New York late Wednesday afternoon, Sept. 26.

Forty Years' Service in One City

Superintendent of Construction Edwin Duty, of the Cleveland Electric Railway Company, of Cleveland, Ohio, whom President Everett, of the company, is in the habit of introducing as the father of the street railways of Cleveland, celebrated the fortieth anniversary of his work as superintendent on Sept. 12. Mr. Duty was the superintendent of the first street car line in Cleveland, and with the advent of electricity mastered that method of operation as he had mastered the running of the horse car lines. There is probably no man in the country with a longer unbroken career as a street railway superintendent, and his recollections of the early days of Cleveland's street railway system are most interesting. Mr. Duty has superintended the construction of every foot of track ever laid by the company, and, despite his long and hard service, is in good health.

Eight Years' Electric Service in Montreal

The first electric car of the Montreal Street Railway was run Sept. 19, 1892, and two days later the road was placed in regular operation. During the eight years that have passed the number of passengers carried have more than quadrupled, the figures being, in 1892, 11,631,000, and for this year it is estimated over 45,000,000 will be moved. The gross receipts of the company in 1892 were $564,406, and in 1899, $1,660,775. The operating expenses in 1892 were $466,647, and in 1899, $912,949. The net earnings of the road in 1892 amounted to $97,761, and in 1899, $747,826. The longest trip a passenger can take on the company's route without a transfer is 7 miles. The time of service is stated by the road's authorities to average one car for every two to two and one-half minutes on all the independent lines during the working day, which lasts from 6 a. m. to 8 p. m. From 2:30 a. m. until 4 a. m. only are there no cars run.

Chicago Elevated Changes

The Metropolitan Elevated Railroad has officially announced a number of important changes in its train service. On and after Oct. 1 special trains will run every six minutes on the Humboldt Park branch in addition to the regular service. There will be improved train service and faster time on all lines. Trains will run every five minutes from 9 a. m. to 5 p. m., instead of every six minutes. Extra service will be given on all lines during the rush hours and special trains will run to and from Canal Street morning and evening. New platforms and rail terminals have been put in at Canal Street on the Logan Square-Humboldt Park tracks of the main line for the convenience of persons whose business is entirely west of the river. The alternate trains leaving the loop during the rush hours on express schedule to Marshfield Avenue will provide for those who have hitherto taken surface lines rather than face the crowds going to or returning from the loop. An equal number of additional trains will start from the Canal Street terminal. It is estimated that the Canal Street service increases the company's net earnings $20,000 a year.

The Annual Meeting of the Pennsylvania Street Railway Assso= ciation

The ninth annual meeting of the Pennsylvania Street Railway Association will be held in the parlors of the Mansion House, Reading, Wednesday and Thursday, Oct. 10 and 11. The convention will be called to order Oct. 10 at 2 p. m. Addresses will be delivered, and papers on scientific subjects of interest to the association will be read and discussed, as well as the interests and welfare of the business generally considered. The business meeting of the association will follow the presentation of the different papers, and officers will be elected for the ensuing year.

On the evening of Oct. 10 those in attendance at the meeting will be tendered a complimentary banquet by the United Traction Company, of Reading, at Rajah Temple. The entertainments for Thursday include an excursion over Neversink Mountain at 10 a. m.; a trip over Mt. Penn Gravity road at 12 m., and a trolley ride to Womelsdorf at 2 p. m.

All members of the association, as well as representatives of other street railway companies and supplymen not members of the association, are cordially invited to attend with as many representatives as possible, and participate in the exercises and entertainments of the association.

English Views of Mr. Yerkes' London Deal

The recent purchase of the franchise of the Charing Cross, Euston & Hampstead Railroad by Charles T. Yerkes, and the subsequent announcement that probably $16,000,000, all American money, will be expended in promoting the enterprise, has called forth considerable comment by the English press. The *Daily Telegraph* and the *Sunday Special* have been foremost in discussing the plans of the Americans, and in recent issues of these papers are found two intensely interesting articles. The *Telegraph* voices itself thus:

"Further developments in connection with electric traction are talked of by Mr. Yerkes, but by far the most startling development is the change which such events as the building of an underground road in London with American capital proves to have taken place in the economic conditions of the United States. Until the last few years Europe had to supply a large part of the capital needed for the development of American industries. In 1895 it was foreign capital that saved her from disaster. Now her capitalists are not only subscribing to English war loans and exchequer bonds and German treasury bills, but an American syndicate declares its intention of spending several millions in order to build a railway in London on which, at best, the profit can be but moderate." The *Sunday Special* says: "This is a striking instance of the aggressive progress of American enterprise. Formerly European capital was supplied to the United States, and it helped to build most of the American steam railroads. To-day American capitalists, not content with supplying money to the governments of Great Britain and Germany, are beginning to compete with English enterprise in that branch of electrical activity which promises the largest return, namely, local electric railways. This cannot but be favorable. If America helps us to develop and to make up-to-date our system of electric traction, she will confer as great a benefit upon us as we did upon her in providing the capital for her steam railroads."

Tunnel to Brooklyn

At a meeting of the New York Rapid Transit Board, held Sept. 28, the routes and plans of construction for a rapid transit tunnel from New York (Manhattan) to Brooklyn were adopted by the board. The plan is to extend the Broadway tunnel to Bowling Green and under Whitehall Street to the East River. Crossing under the river, the tunnel will reach the Brooklyn shore at the foot of Joralemon Street between Furman Street and the shore line, run under Joralemon Street to City Hall, where there will be a station; then under Fulton Street to Flatbush and Atlantic Avenues, where for the present will be the terminus. The river part of the tunnel with its approaches, from Bowling Green on the New York side to near the City Hall in Brooklyn will consist of cast iron tubes of 15-ft. inside diameter, forming practically a separate tunnel for each track. Two loops will be built at the Brooklyn City Hall, one below the other. One of these will be used for New York trains. The other will be constructed with a view to the future when the extension of the tunnel further into Brooklyn will necessitate the running of local trains within that borough. The simultaneous building of the two superposed loops will mean a saving of money. The approaches to the loops, from Henry Street on one side and from Smith and Jay Streets on the other, will be wide enough to leave room for four tracks. The plans also provide for an additional loop on the New York side, beginning under Broadway, somewhere near Exchange Place, and running under Bowling Green, State Street, Battery Park and Whitehall Street back to Broadway. Different grades will be provided for trains turning into this loop and the through Brooklyn trains. It is estimated that the length of the extension will be 4¼ miles, of which distance 7500 ft. will have cast iron tubing. The estimated time required for the trip from one City Hall to the other is eight minutes. The extension may be completed within two years from the time work is begun on it.

Before contracts for construction can be let, the proposition must, first of all, go before the Municipal Assembly. If it is approved by that body the consent of the property owners must be obtained, which may require a whole year.

The New Power House of the Northern Ohio Traction Company

The Northern Ohio Traction Company, of Akron, is about ready to begin operating its new plant in that city, superseding the old lighting and railway plants. The object of combining the plants was to centralize the power, and at the same time to make the service more efficient. The new plant is one of the largest and most complete in Ohio, and the new lighting system will be one of the first in the State embodying the use of series alternating arc lamps. The plant will furnish power for the city lighting and city railway lines, and for a portion of the Akron, Bedford & Cleveland line of the Northern Ohio Traction Company.

The boiler room will be equipped with eight Sterling boilers, four of which will be equipped with mechanical stokers, while the other four will be hand-fired. The boilers will be supplied with feed-water from six duplex pumps. In the engine room there will be three horizontal cross-compound condensing engines of the Cooper-Corliss type, two being directly connected to the railway generators and to an alternating-current generator. The railway engines are capable of developing 1800 hp, running at 90 r. p. m., with 140 lbs. of steam. The other engine will develop 750 hp. These engines are directly connected to Westinghouse 500-volt railway generators, one 800-kw capacity, and one 400-kw capacity. The railway service will be further strengthened by the addition of a 200-kw generator, making a total of 1400 kw capacity. The lighting end of the equipment will be cared for by one engine, directly connected to a 500-kw alternating-current generator.

The switchboard is 46 ft. long, and made of marble slabs of blue Vermont marble, 2 ins. thick. The railway switchboard consists of three machine panels, one load panel, one blank, and four circuit panels. The machine panels are each equipped with switches, ammeters, rheostats and circuit-breakers. The load panel is equipped with a 4000-amp. ammeter and a swinging differential voltmeter, this meter being used for operating only two machines in parallel. The circuit panels are each provided with a single-pole knife-switch, one ammeter and a brush type circuit-breaker at the top of the boards. The lighting switchboard consists of eleven panels, as follows: One double exciter panel, one 200-kw machine panel, one 500-kw machine panel, one blank, four incandescent panels of two circuits each, and three arc panels, panels of three circuits each.

The A. S. R. A. Convention

As previously announced, the nineteenth annual meeting of the American Street Railway Association will be held at "Convention Hall," Kansas City, Mo., Oct. 16, 17, 18 and 19, 1900.

Papers will be read on the following subjects:

"Consolidation of Street Railways and Its Effect upon the Public," by Daniel B. Holmes, counsel, Metropolitan Street Railway Company, Kansas City, Mo.

"A Comparison of the Various Systems of Electrical Distribution for Street Railways," by C. F. Bancroft, electrical engineer, Massachusetts Electric Companies, Boston, Mass.

"Painting, Repainting and Maintenance of Car Bodies," by F. T. C. Brydges, superintendent of car shops, Chicago Union Traction Company.

"The Store Room and Store-Room Accounts," by N. S. Hill, Jr., general manager, Charleston Consolidated Railway, Gas & Electric Company, Charleston, S. C.

"Double-Truck Cars; How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions," by N. H. Heft, president, Meriden Street Railway Company, Meriden, Conn.

Friday, Oct. 19, has been set apart as a day for the examination of the exhibits. No session of the association will be held on that date, so that all may have plenty of time to view the exhibits. It is earnestly requested that managers have their heads of departments present on that day.

The annual banquet will be held at the Coates House, Friday evening, when the officers elect will be installed.

The headquarters of the association will be at the Midland Hotel. The principal hotels in Kansas City and their rates are as follows:

Midland, American, $3 to $6 per day; European, $1 to $5 per day.

New Coates, American, $3 per day and up; European, $1 per day and up.

Savoy, American, $2.50 to $6 per day; European, $1.50 to $3.50 per day.

Baltimore, American, $3 to $5 per day; European, $1.50 to $3 per day.

All are first class and in close proximity to the hall.

The executive committee advises all who desire rooms to apply at once.

The passenger associations have, as usual, granted a rate of one and one-third fare, on the certificate plan, provided one hundred or more tickets are purchased. All persons intending to attend the convention are cautioned to get certificates when they purchase their tickets and to deposit these certificates with clerk upon arrival at the hall. He will have them signed, and will return them, on application, on Thursday, Oct. 18. Under this plan no one can get a return ticket at reduced rates if he fails to secure a certificate when he purchases his ticket, so the importance of this is evident.

The managers of the Kansas City railway systems have arranged a most attractive programme for the entertainment of the delegates, and a very large attendance is indicated.

The Storage Battery—Its Use in Railway Plants

BY THOMAS HENNING

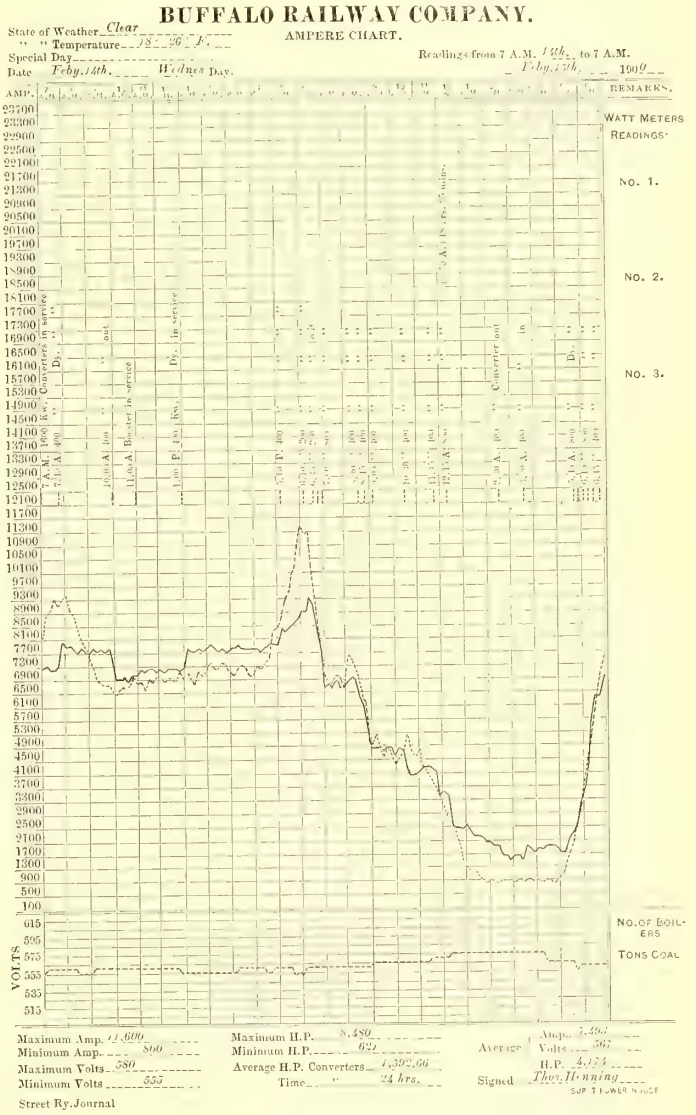
Of the many factors involved in the construction and maintenance of railway power stations, I know of none more prominently identified therewith than the storage battery. The storage battery, however, resembles any mechanical or electrical appliance in this, that it cannot after installation be left to the care of Divine Providence. If attended to, regularly and intelligently, it will require but little care; if neglected, it will require more care, and at the same time it will have low efficiency.

The application of the storage battery to electric railway work has to do largely with the variations of load. If a load were absolutely constant throughout the twenty-four hours, the utility of the battery would be confined to emergency work in case of accident to the machinery, etc.

Variations of load in railway work are of two kinds: first, momentary fluctuations; second, peaks which extend over a length of time from half an hour to four or five hours. Under this latter head must be considered not only those portions of the load which are above the average, but also the very light loads between midnight and morning.

In most railway loads, peaks and fluctuations are combined; in the small systems the fluctuations predominate, while in the larger plants the peaks are more prominent, the fluctuations, while large, being small compared with the total load. Power house machinery attains its maximum efficiency under a steady sustained load equal to its full capacity, while the efficiency of the battery is greatest under rapidly fluctuating loads or short period discharges if heavy, or under light loads if prolonged. It will be seen that in order to produce the variable output required for electric railway service, with highest economy, the combination of machinery and battery, properly proportioned, forms the ideal arrangement, each taking that portion of load which it is best adapted to handle.

The proportion between the capacities of machinery and battery will evidently depend upon the characteristics of the load curve. As the size of the battery for continuous peak work increases with the length of time it is called upon to discharge, as well as with the rate of such discharge, it is desirable, in order to avoid excessive first cost, to plan to utilize the battery up to its one-hour rate. On this basis, the cost of the battery will be approximately the same as the equivalent capacity of machinery, including boilers, engines, generators, etc., installed.



(The dotted line shows the actual load on station; the solid line, the output of the generators.)

SAMPLE DAILY SHEET OF OUTPUT, BUFFALO

This one-hour basis does not mean that the battery is limited to a peak of one hour's duration; a battery may be utilized for a peak of load lasting three or four hours, and yet be discharged at times during that interval considerably beyond its one-hour rate, without exhausting its capacity. Load curves of such a nature as to permit this are the rule, and not the exception, in railway work.

On almost any railway load diagram it will be possible to draw a horizontal line, such that all that portion of the load above this line can be carried by a battery working occasionally up to its one-hour rate. This will usually determine the best proportion between battery and machinery.

At the Niagara Street station of the Buffalo Railway Company, we have a battery of 270 cells, sixty-three plates in each cell, capacity 2000 hp-hours. The battery is in series, with a booster, the latter having a capacity of 3000 amps. at 70 volts. The shunt coils

of this booster are attached to a contrivance in the shape of a switch and rheostat combined, by which the potential may be lowered, raised, or the direction reversed.

The battery and booster are in parallel with the dynamos or converters, as the case may be, and by the manipulation of the switch and rheostat above mentioned, the battery may be charged by a 550-volt machine as high as 620 volts, or it can be discharged when the voltage of the battery proper is below that of the dynamo or converter.

The booster and battery being in series, a movement of this switch in a stated direction will have the effect of giving the booster say 50 volts, opposing the battery voltage. Thus, if the battery voltage be 595, and the booster 50 volts in the opposite direction, the difference of potential between the mains will be 545 volts, thus permitting a 550-volt machine to charge the battery. By reversing the polarity of the booster we reverse the operation. Battery voltage being low, say 505 volts, plus booster, 50 volts, permits the battery to discharge on a 550-volt bus-bar.

This battery has been in service since April, 1898. The length of time that a battery has been in service and the work performed by it have a bearing upon the care required, for the reason that as sediment is deposited in the cells, it reaches a point where care is required to prevent the sediment connecting the plates temporarily, and thus rendering a part of the battery inoperative.

Notwithstanding the length of time this battery has been in service, one man working ten hours per day does all that is necessary, and at times has three or four hours to spare for other duties. However, when the sediment reaches this stage, the better plan will be to have it removed entirely, choosing a convenient time for this work.

Immediately after this battery had been placed in service, I adopted a system of readings of battery charge and discharge from which curves can be traced, and the average work of the battery shown graphically. Copies of these charts accompany this paper and will be understood at a glance. In addition to acting as a regulator during part of the day, it has at times discharged from two to four peaks during twenty-four hours, the base of one of these peaks covering an interval of from three to five hours, the maximum output being 2500 amps., and at times more than this.

It is not necessary in order to secure the highest efficiency that the curve of the generator load shall be represented by a horizontal line of uniform output throughout the twenty-four hours, indicating no change in the number of units in operation, but it is desirable that whatever machinery is running at any time shall be fully loaded. The diagram of generator load will thus consist of a number of rectangular steps.

The element of uncertainty in a railway load, as to time and amount, makes the battery particularly adapted to this class of work, combining, as it does, the ability to stand momentary excessive overloads with its readiness to pick up its load at a moment's notice.

I have endeavored during the past year to obtain some facts bearing upon the length of time the plates will last. I confess that I am no nearer a solution than I was a year ago. After seeking industriously, I have arrived at the conclusion that the present form of battery has, as yet, presented an unbroken front; in other words, that since its adoption no plates have been worn out. If so, I have been unable to locate them. There are no visible indications of the plates of this battery giving out at an early day.

The gases from these batteries have a deleterious effect upon matter in the same apartment. I have found that a coating of silica-graphite paint of so-called natural color prevents any bad effects. These gases after leaving the building I believe to be harmless.

On the 23d of last June, at the suggestion of President Ely, I placed pieces of metal outside of a roof ventilator, at distances from the ventilator varying from 2 ins. to 4 ft., and up to the present time I find no indications of the metal being attacked by the gases. In conclusion, permit me to say that if a battery is a good thing in a large station, its usefulness increases in small stations inversely as the load. When one sees small units in service with no load, and 50 per cent overload, each reading following the other in rapid succession, the use of a battery in small stations will readily suggest itself.

Rotary Transformer Stations*

BY R. E. DANFORTH

The largest utilization of water power for street railway purposes in the world is that of the lines owned by the International Traction Company, of Buffalo, N. Y. This company controls the Buffalo Railway Company and other concerns operating in and between Buffalo and the neighboring cities. The consolidated companies now operate all lines in Buffalo, Tonawanda, Lockport, Niagara Falls, N. Y., Niagara Falls, Ont., and Queenstown, as well as the electric interurban lines between these points, with the exception only of the Gorge Road and of three small suburban lines which feed the Buffalo system. The lines operated by these allied companies have an aggregate length of about 300 miles of track, and are traversed by about 400 electric cars.

The International Traction Company possesses one of the most perfect steam power stations in the country, the famous Niagara Street station, with a capacity of 7500 hp in large units, driven by condensing engines, supplied from boilers with complete labor-saving devices, such as stokers, coal and ash handling mechanism, etc. In this station there were installed in the fall of 1896 two 400-kw rotary converters, and accompanying transformers, built by the General Electric Company, these machines being designed to take some of the 25-cycle polyphase power transmitted to Buffalo from Niagara Falls, and convert it into 600-volt direct current, suitable for street railway use. These machines were duplicated a year later, giving a total converter capacity of 1600 kw. These converters, with the engines, assisted by a 3000-amp. storage battery, operated the lines in Buffalo until 1899, when increased generating capacity, or improved power distribution, became necessary. The operation of the rotary converters in the Niagara Street station, as well as that of others serving lines of the allied companies in Lockport, Niagara Falls and Tonawanda, had proved so satisfactory and economical that the company decided to get this increased capacity by an enlargement and distribution of its converter system rather than by any additions to its steam-driven equipment. The rotary converter system has now been extended until it is capable of supplying the whole demand without assistance from the steam plant except during load peaks.

In addition to the lower cost of power derived from a rotary converter system, supplied by a hydraulic plant, as compared with a steam-driven station, the former system possesses the advantage that the converters may be distributed in a number of sub-stations scattered through the territory to be supplied with power and advantageously located to carry the heaviest loads with short feeders. Having no boilers or engines, the location of the sub-stations is not influenced by considerations of fuel supply or condensing water. Having no objectionable features, such as smoke stacks or exhaust steam, the sub-stations can be located anywhere without impairing the value of neighboring property. Requiring but a small area per kw-capacity, they can be put in where property is expensive.

Full advantage of these possibilities has been taken by the International Traction Company, which has divided its new equipment into four sub-stations, scattered through the city, giving, with the Niagara Street station, five sources of direct current in the city of Buffalo, in addition to the sub-stations in neighboring cities. The effect has been to materially reduce the amount of copper needed, as well as to reduce the drop and loss in the overhead feeders and in the track return. Better voltage is maintained at the cars, allowing them to make fast schedules without overheating of the motors.

The sub-stations have in all cases been located in existing car houses. Each contains either two or three rotary converters, all of which are of the same size, and, as the sub-stations are very similar to each other, a description of one will serve for all.

In general, each sub-station consists of a room about 30 ft. x 50 ft. in size, along one side of which are ranged the rotary converters, and along the other side the transformers, the switchboard being placed across one end of the room. Each sub-station is served by a hand crane.

Power is received in the form of three-phase currents at 10,500 volts from an underground three-conductor cable of the Cataract Power & Conduit Company, one branch cable running to two of the new sub-stations. At each sub-station the power enters through a Form H oil switch, operated by hand, by means of which the whole station can be instantly cut off from the high-tension supply cable in case of an emergency. From this oil switch the power passes through automatic circuit-breakers, actuated by an overload time element relay. This relay actuates the breakers only in case the overload drawn through it continues for a predetermined time, such as three or five seconds. In case a short-circuit exists on the direct-current side it is quickly removed by the direct-current breakers, which do not allow it to exist long enough to actuate the time element relay and circuit-breakers in the alternating current supply connection. Thus these breakers are not tripped, and the rotaries are not thrown out of synchronism with the supply system each time a severe overload or short-circuit comes upon the direct-current lines. In case, however, a short-circuit occurs in the station, and lasts through the period of the time element re-

* Paper read before the New York State Street Railway Association Sept. 18-19, 1900.

lay, this instrument will operate and throw out the high-tension circuit-breakers, cutting the supply off from the sub-station.

From the high-tension circuit-breakers the power passes to the high-tension bus-bars, from which it is drawn by the step-down transformers.

Each 400-kw converter is permanently connected to its own group of three 150-kw step-down transformers, with no intermediate switches or bus-bars in the low-tension A. C. circuits. Thus each transformer-converter unit is handled on its A. C. side by the high-tension switches, through which it receives its power from the high-tension bus-bars. Form F oil switches are used for this purpose, three single-pole switches being connected in the three-phases, going to the primaries of the step-down transformers. These three switches are located in separate brick chambers, with brick barriers between them to prevent a burn-out of one switch from spreading to the others. All of the high-tension switches, as well as all high-tension instrument transformers, are located on a gallery above the switchboard.

The switchboard attendant can handle all switches and read all instruments from the floor below, the switches being mechanically connected down to handles on the A. C. panels with insulating joints in the connections, the instruments being connected to transformer secondaries only. Thus there is no high potential on the operating board, either front or back, and no necessity for the attendants to visit the high potential gallery in the ordinary course of operations.

The risk of shock to the attendants is thereby reduced to a minimum. The step-down transformers are of the air-blast type, and are mounted in a row over a forced draft chamber, on each end of which is placed a centrifugal fan, direct-driven by a 500-volt D. C. motor. Each fan is capable of supplying sufficient air for all the transformers. Thus a duplicate source of draft is provided.

Mounted also over this forced draft chamber, and cooled by air taken from it, are three-phase reactive coils of the air-blast type. There is one of these for each rotary converter, and they are connected between the secondary coils of the transformers and the collector rings of the rotaries. Their purpose is to allow the voltage delivered by the rotary to be varied by adjusting the field rheostat and compounded by the use of a series field.

An alternating-current motor, driving a direct-current generator, will obviously accomplish the work of converting A. C. current into D. C. currrent at 600 volts, and such machines have frequently been used for the purpose, but experience has shown that the motor generator is, as a rule, inferior to the rotary converter, since the latter combines both an alternating-current motor and direct-current generator in one dynamo-electric machine, with only one field magnet structure and one armature, and therefore the latter method is here described. It may be stated at this point that the rotary has a higher efficiency and a lower first cost, occupies less floor space, requires no more attention, and gives no more trouble than the motor-generator, making it the preferable machine, except in some few special cases where unusual conditions call for motor generators.

The rotary converter resembles closely, both in appearance and performance, a direct-current generator. Since it is self-driven and is therefore not coupled to any prime mover with speed limitations, it is designed more on the lines of a belted than a direct-coupled generator, and, indeed, bears a striking likeness to the former. The only apparent difference is the omission of the pulley and the addition of a set of collector rings, through which the alternating-current supply enters the armature. There is only one winding on the armature, and this winding is exactly like that of a direct-current generator, with the sole exception that in addition to being connected to the commutator in the usual way, the winding is also connected at suitable points to the collector rings. Thus the alternating currents enter the same winding from which the direct currents leave. An idea of the way in which both currents can exist simultaneously in the same armature conductors can be given as follows: As is well known, any armature coil or set of coils is the seat of an alternating electromotive force when the machine is in operation, and it is only by commutation that these alternating e. m. f.'s are changed into a steady direct pressure. These alternating e. m. f.'s act as the counter e. m. f.'s opposing the incoming alternating currents which enter through the collector rings, and therefore reach the armature windings uncommutated. The same internal e. m. f.'s rectified by the commutator give the direct-current pressure. This partial neutralization between the incoming and outgoing currents gives the machine a large output per pound of weight and a high efficiency.

DETAILS OF CONSTRUCTION

The rotary converters, built by the General Electric Company, have many of the same features of structural detail that distinguish the direct-current generators of the same make. The external yoke of the field frame is made of cast iron, and its upper half is fastened to the lower half by bolts hidden completely within recesses cored in the side supports, thus doing away with unsightly projections and improving thereby the appearance of the machine. The poles also embody the same features as those of the generators, being solid steel castings, bolted to the yoke ring, so that any pole can be removed for the repair of its winding without disturbing the yoke ring. This construction is particularly advantageous in the case of trouble with any field coil on the lower half of the ring, the removal of such a coil from a machine with poles solidly fastened to the yoke requiring that the armature be lifted out of the bearings.

The lower half of the yoke ring is cast separately from the bed-plate, so that in large machines the whole field ring may be moved along the bed-plate in the direction of the shaft, to give access to the armature. The field ring or the bearing pedestals may be shimmed up, and the field ring may be moved laterally to render the armature concentric with the poles, and this adjustment may be readily changed at any time as the bearings wear.

The poles have extending tips, which distribute the magnetism over a great number of armature teeth, and thereby reduce the density, the iron losses and heating in this part of the machine. The fields may be shunt or compound-wound, to obtain the desired regulation, and the effect of the series-coil may be adjusted by a variable shunt exactly like that used on direct-current generators.

The armatures, like those of the generators, are designed to give forcible ventilation, and thereby keep all parts cool. The spokes have wings or vanes cast to them, these wings being enclosed by deep end flanges, so that a powerful centrifugal fan action is set up, blowing air between the armature laminations, across the armature windings and around the field poles. The armatures are, as a rule, bar-wound, the upper bars being connected to the lower bars by soldered clips on the collector ring end of the armature, so that an upper bar can be removed without disturbing any other coil, and a lower bar can be removed without disturbing more than one-half as many coils as must be disturbed for the removal of one bar of an armature in which the complete turn is made of one piece.

The armature winding is held in the slots by wooden retaining wedges, the end connections being fastened by binding bands, these details being the same as those of generators.

The connection of the winding to the collector rings serves incidentally the same purpose as the equalizer rings used on parallel-wound generators, equalizing the field strength under all poles and improving commutation.

The commutators of rotary converters are of the same design as those of D. C. generators. The collector rings are separated from each other by wooden insulating rings, which rise above the collector ring surface to such a height that if an arc is started accidentally between collector rings it will not continue and become a short-circuit. The collector rings are cut away at the sides to allow the brushes to bear upon them over their full width, thus preventing the brushes from leaving shoulders beside their tracks in the center of the rings. Carbon brushes in solid shank brush holders of the standard D. C. type are used on the commutator, while laminated copper leaf brushes are used on the collector rings.

On the small machines the brush-holder rings are supported on the bearing pedestals. On the larger machines the D. C. brush holders are supported by a latticed cast-iron ring, fitting a seat in the field-magnet yoke; the A. C. brush holders being mounted on a platform bracketed to the bed-plate. The A. C. brush-holder rings are conveniently jointed and swiveled to allow easy access to all parts.

To distribute the wear on the commutator and collector rings, and to prevent the brushes from wearing grooves in these parts, all rotary converters made by the General Electric Company have automatic oscillators, or end-play devices, which, at frequent and regular intervals, give the armatures a slight motion back and forth in the direction of the length of the shaft.

All converters with a capacity of 500 kw, or more, are made six-phase instead of three-phase, in order to increase the efficiency by reducing the losses in the armature winding. The larger number of phases causes the alternating currents more nearly to balance the direct current in the winding, distributes more uniformly the remaining losses, and provides more equalizing connections, thus improving the commutation.

The six-phase converters are supplied by three single-phase transformers, the only difference in structure and connections being the use of six collector rings and six conductors from the transformers to the converter in place of three.

THE STARTING OF ROTARY CONVERTERS

When running at full speed the manipulation and operation of a rotary converter are exactly the same as those of a direct-current generator, but, there being no steam engine, water-wheel or other

outside source of power for bringing a converter from standstill up to speed, the converter must in some way be made self-starting. If there is available in the sub-station some other source of direct current the converter may be started as a direct-current shunt-wound motor. If there is no other source of direct current than the converter itself, it must be made self-starting from the alternating-current circuits, since it will not deliver direct current until it has reached full speed. The rotary converters made by the General Electric Company are so designed as to be self-starting without any special starting device, such as a separate starting motor. The alternating currents are simply switched into the windings of the converter itself, and the machine comes up to the proper speed.

The rotary converters are six-pole machines, and hence, with 25-cycle-current, run at 500 r. p. m. They are fitted with magnetic oscillators, which give the shaft an endwise pull at regular intervals of a few seconds, thus preventing the brushes from wearing tracks in commutators or collector rings. The machines are compound-wound, and fitted with equalizer switches, mounted on the field yokes. They are so placed that the commutators face the central passageways of the sub-stations, the collector ring ends being turned to the wall.

The switchboards contain both A. C. and D. C. panels in one continuous row. To one end are the A. C. panels, one per rotary, next to them come the D. C. panels of the rotaries, next to which is the main D. C. panel, beyond which are the D. C. feeder panels. Each A. C. panel contains the handle of the high-tension switch on the gallery above, in addition to one A. C. ammeter and voltmeter, and synchronizing receptacle and lamp. An induction wattmeter is mounted on one panel, and connected to a current transformer in the high-tension A. C. bus-bars so as to record the total input of the sub-station. Mounted on the sub-base of one of the A. C. panels is the time element relay, and on the same panel is a push-button, by which the relay circuit can be closed by hand to trip the A. C. breakers in case of necessity or for testing.

Each D. C. rotary panel is of the General Electric standard railway generator type, containing two main switches, an astatic ammeter, circuit-breaker, field rheostat and so forth.

The only apparatus required for rotary converters and not required for generators is two switches mounted on the sub-base of the panel. These are used in starting the converter as a direct-current shunt motor.

Mounted on the sub-base of the main panel is a rheostat switch, which can be used for starting any rotary, being transferred from one rotary to another by means of a transfer switch on the sub-base of each D. C. rotary panel. In addition to this transfer switch there is a field switch, by means of which the field may be excited from the bus-bars while starting the machine.

The main panel also contains a main recording wattmeter for measuring the total sub-station output of direct current, and an astatic main ammeter and voltmeter, the latter being connected to receptacles on the converter panels, so that it may be made to read the voltage of any machine. The main ammeter and voltmeter are mounted double-deck fashion on a bracket, so that they may be swung around to face in any desired direction.

The outgoing feeder panels are equipped as usual.

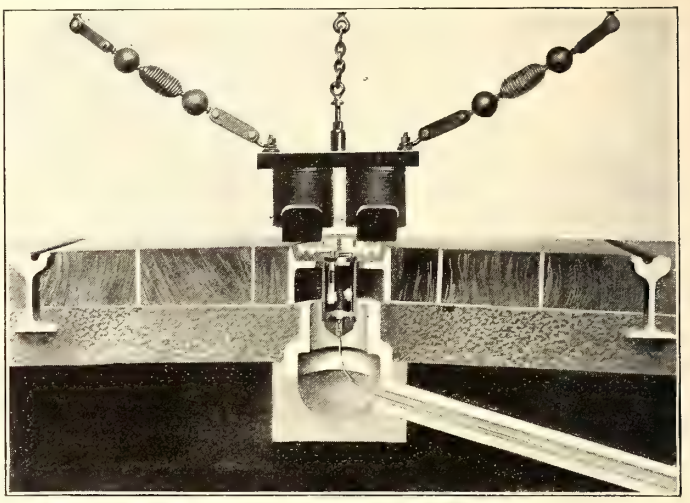
Provision is made in all cases to start the rotary converters by means of direct current. Two of the new sub-stations contain storage batteries, from which the rotaries may be started; the other two are fitted with motor generator sets. Each set consists of a 20-kw, 500-volt generator, coupled to a 30-hp induction motor, which is supplied from the high-tension lines by means of suitable step-down transformers. This induction motor is started by simply closing the high-tension side of its step-down transformers to the incoming line. When up to speed the generator is excited, and by means of it any one of the rotary converters may be started as a direct-current motor, and accurately synchronized by adjusting its field strength.

Each sub-station is operated with only one attendant, and the amount of attention required by the machines is so small that this one attendant is idle or available for other work a large part of the time. The starting of these sub-stations has greatly improved the service by reducing the amount of feeder copper needed, by raising the efficiency of 500-volt distribution, and by steadying the voltage throughout the network.

Electric Traction at the Paris International Electrical Congress

At the International Electrical Congress, held in Paris Aug. 18-25, the subject of electric traction assumed a prominence apparently not anticipated by those who drew up the programme of the congress. Originally the electric railway was included in Section II., dealing with electric lighting and the production and the chemical utilization of electricity. It was soon seen that this section had a scope too wide, and it was finally divided into three sub-sections of which one had sole cognizance of electric traction.

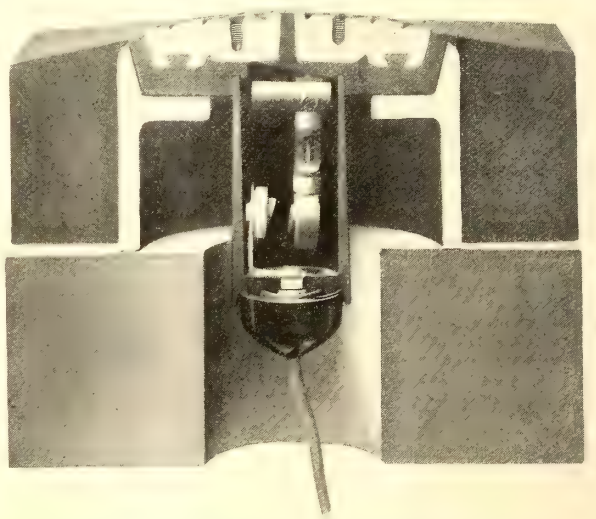
The proceedings in the electric traction sub-section were at times enlivened by the cross-examination of inventors of rival systems. Few of the papers read in this section were printed, and most of the subjects on the programme were expounded off-hand, many points being brought out or elucidated by questions from



GENERAL SECTION OF TRACK EQUIPMENT IN THE DOLTER SYSTEM

the audience. Almost the entire time of the sittings was taken up by expositions of the Dolter, Diatto, Vedovelli and Bede systems of surface contact railways, the inventor in each case acting as spokesman.

The Bede system is employed on an experimental line in Brussels, about 1200 ft. in length. The conductor is placed in an iron conduit located alongside of one of the rails, from which it is separated by a groove about 1 in. wide. A plow or shoe travels in this groove, and spaced every 3 ft. are contact buttons, by means of which current is obtained for the motor. The contact device consists of a button-headed rod which, when depressed, makes contact with a portion of the cable at a point at which the



SECTION OF CONTACT BOX. DOLTER SYSTEM

insulation has been removed. This contact piece is held in a rubber stopper or plug, the function of which is, first, to support the contact piece; second, to seal the conduit containing the conductor, and third, to act as a spring to break the current when the plow passes away. Normally the contact device is ⅛ in. distant from the conductor. Mr. Bede stated that the trial of the system has shown the insulation is well maintained, the passing of carriages has no adverse influence, no difficulty is found in keeping the groove clean and there has been no accident to man or beast. The entire conduit rests on the ties.

Prof. Blondin, for Mr. Dolter, described an electric railway surface-contact system now being operated over a line a ¼ mile long in the outskirts of Paris, and known as the Dolter system. This surface-contact system is worked magnetically. The car

magnet or shoe is excited by the current operating the car or from a small storage battery on the car. In passing over a box this magnet draws up a cylinder of iron constituting one of the arms of a knuckle joint, and the other arm then brings into contact two carbon discs of which one is connected to the feeder and the other to the surface plate of the contact box—the latter thus becoming active and delivering current to the shoe and motor. One feature of the system is that one of the disc leads contains a fuse, which will blow in case of a short circuit between the contact knob and the rails. The general arrangement of the system is shown in the accompanying engravings.

The Diatto system, which is also a magnetic system, was described in full in the STREET RAILWAY JOURNAL for July, 1899. It is in use on a short section of line at Tours, France.

Mr. Claude also read a paper on electrolysis from railway return currents, giving a resumé of the more important literature to date. His conclusions are that the ill effects of electrolysis are eliminated by an observance of the 5-volt drop rule, or even by limiting the drop to 1 2/5 volts per mile, for the reason that either limits to 1.5 volts the pressure between rails and piping. As this is the real criterion, Mr. Claude considers that the regulations should consist of this provision, *i. e.*, a limit of this pressure to 1.5 volts, and also that the connection of piping with rails should not be allowed.

Mr. Leon Gerard described the system of electric traction employed on the canal from Brussels to Charleroi. Three-phase currents are used, part of the energy of the line being devoted to lighting and power along the canal. The line is 48 miles long, and serves two sub-stations, one 17 miles from Brussels and the other 6 miles from Charleroi. There are three generating units of 150 hp each, producing current at 6000 volts. Part of the current is used along the line for power and lighting. The haulage is performed by means of motors on four-wheel cars, which do not run on rails, but on the canal bank formerly used in horse traction. In places where traction by the motor cars becomes difficult, as in narrow passages at quays, etc., the boats are towed by electric launches receiving current from the line. The speed of haulage is 2.4 miles per hour for boats loaded, and 4.8 miles for empty boats. The efficiency of the generator is 93 per cent, and of the transformers 97 per cent. The efficiency between the dynamo and the boat towed is 27.5 per cent. The price of towing is one-tenth cent per ton. The system has been operating regularly since October, 1899, and moves 600,000 tons annually.

Colonel Renard discussed the formula given by Mr. Ernest Gerard for the resistance of a motor car—

$$f = 1.8 + .04\ V + \frac{.0415\ V^2}{T}$$

Expressing V in meters per second, and not kilometers per hour, the formula becomes—

$$f = 1.8 + .144\ V + \frac{.54\ V^2}{T}$$

Colonel Renard shows that the last term, which refers to the resistance of air, is in remarkable accord with the general results of experiments on plane surfaces. He also spoke of the importance of the shape of the fore and after parts of cars for high speeds.

Annual Meeting of the Railways Company General

The first annual meeting of the Railways Company General was held at Camden, N. J., Sept. 17. Directors were re-elected as follows: Evans R. Dick, R. H. Rushton, J. Ogden Hoffman, Jay Cooke, 3d., George S. Graham, W. W. Gibbs, J. R. McAllister, S. B. Vrooman and R. I. McKinstry. President Evans R. Dick presented the following report:

The company was organized under the laws of New Jersey in August, 1899. President Evans R. Dick in presenting his report said, in part: "As the properties owned by the Railways Company General were acquired from time to time during the year, and as their business was to a very large extent construction work, no statement of earnings can be furnished that will render a fair account of the company's business. The company owns first mortgage 5 per cent bonds secured upon electric roads amounting to $1,325,000, as well as stocks in various electric roads, electric lighting and other corporations amounting at par value to $1,055,750, and valued by the previous board of directors at $444,500. During the month of July, through the purchase of a large block of stock of the Railways Company General, the management was changed, and since then the work of arranging the finances of the company and readjusting its accounts has proceeded, and, in due time, when the earning power of the property becomes more established, the assets of the company will be revalued and a new balance sheet issued by your present board. It is well to say in this connection that the system of roads owned and controlled by your company (omitting the Newtown Electric Railway,which is not controlled) earned $22,203 gross for July, and $26,999 for August. The general manager of the company believes that the system of roads can be operated at 50 per cent. As the result of these various roads for the ensuing year is a matter of conjecture, your management prefers to make no predictions as to the amount of money that will be earned, although it would appear that the interest upon the first mortgage bonds should be earned with a safe surplus besides. Since the present management came into office, an arrangement was made with the Investment Company of Philadelphia for an advance of $300,000, which was used in paying off various liabilities incurrred for construction, etc., and also providing the company with funds enabling the various subsidiary companies to place their roads and equipments in condition for the most economical management. The annexed balance sheet as of June 30, 1900, is hereby respectfully submitted, as well as a brief description of the assets of the company:

Trial balance June 30, 1900

Capital stock		$1,500,000
First mortgage bonds	$1,325,000	
Stocks owned	444,500	
Interest account	123	
Mortgage		100,000
Bills receivable	3,500	
Furniture and fixtures	1,473	
Bills payable		121,648
Accounts receivable	187,843	
Accounts payable		173,000
Cash	407	
Due to companies and individuals		92,363
Sundries	24,163	
	$1,987,011	$1,987,011

LIST OF BONDS OWNED BY THE RAILWAYS COMPANY GENERAL

	Par value
Michigan Traction Company, first mortgage 5 per cent bonds	$600,000
Newtown Electric Street Railway 5 per cent bonds	200,000
Elmira & Seneca Lake Railway 5 per cent bonds	300,000
Lewisburg, Milton & Watsontown Passenger Railway 5 per cent bonds	150,000
Montoursville Electric Street Railway 5 per cent bonds	75,000
	$1,325,000

LIST OF STOCKS OWNED BY THE RAILWAYS COMPANY GENERAL

	Par value
Lewisburg, Milton & Watsontown Passenger Railway Company	$150,000
Milton Electric Light & Power Company	27,750
Montoursvillle Passenger Railway Company	75,000
Montoursville Electric Light Company	10,000
Elmira & Seneca Lake Railway	153,000
Michigan Traction Company	400,000
American Engineering Company	200,000
Newtown Electric Street Railway	40,000
	$1,055,750

Annual Meeting of the American Railways Company

The annual meeting of the American Railways Company was held at Camden, N. J., on Sept. 20. The reports of both the president and secretary were received and filed, and directors were re-elected as follows: John S. Bioren, Samuel G. DeCoursey, William F. Harrity, A. A. McLeod, Edward J. Mathews, Clarence Miller, Silas W. Pettit, Samuel R. Shipley, J. J. Sullivan and William H. Shelmerdine. The report of the president covers the period dating from the incorporation of the company, April 21, 1899, to June 30, 1900, a period of about fourteen months. The surplus earnings are given at $94,736. A portion of the period under report was spent largely in conducting negotiations for the purchase of properties, and it is set forth in the report that payments on stock subscriptions have averaged only about eight months prior to July 1, 1900, so that the $94,736 surplus represents net earnings on the entire $3,750,000 capital for eight months only, or at the rate of 4 per cent per annum.

In addition to the payment of the dividends and interest upon the securities owned by the American Railways Company, the several companies controlled by the company earned a surplus of $74,892. This sum is equal to an additional earning for the eight months at the rate of nearly 3 per cent, showing aggregate earnings of over 6 per cent per annum.

The American Railways Company has not owned all the companies which it now controls for the entire year, so that the entire yearly income of these companies was not received by the American Railways Company, and the following figures, covering the period from July 1, 1899, to June 30, 1900, give an idea of the earning capacity of the company, had the company operated its entire system for the full period named:

Gross		$603,606
Expenses		320,573
Net		283,093
Taxes and interest		101,701
To which should be added:		
Interest on bonds owned by the A. R. Co.	$31,500	
Dividend on preferred stock Chicago Union Traction Company	25,000	$56,500
		$237,892

The treasurer's report from April 21, 1899, to June 30, 1900, is as follows:

Income		
Interest on bonds owned by the company	$36,749	
Dividend on stocks owned by the company	107,331	
Gross income		$144,081
Deductions from income		
General expenses	$16,188	
Printing and registration of stock, stamp, tax	6,090	
Balance interest account	16,784	
Expense, legal	2,514	
Charter and expense of incorporation	5,024	
Taxes	2,500	
Depreciation of office furniture and fixtures and of engineering department instruments	312	
Total deductions from income		49,344
Surplus		94,736

General balance sheet of June 30, 1900, shows:

Assets	Total Issue	Owned by A. R. Co.	Cost
Springfield Railway Company first mortgage 6 per cent	$500,000	$500,000	$500,000
Springfield Railway Company inc. 5 per cent	100,000	98,748	78,998
Springfield Railway Company capital stock	1,000,000	949,100	57,228
Bridgeton Electric Company	25,000	25,000	25,000
Bridgeton & Millville Traction Company	200,000	200,000	230,689
People's Railway Company	1,100,000	1,095,700	1,316,386
Springfield Light & Power	200,000	200,000	190,203
Joliet Railroad Company	600,000	597,700	498,807
Chicago Union Traction	Pref. 500,000 / Com. 250,000		500,000
			$3,397,313
Total cost of stocks and bonds			
Bills receivable, accounts receivable, etc.			272,793
Tax on capital stock paid from July 1 to Dec. 31, 1900			2,500
Bridgeton Electric Co., new power station			62,018
Bridgeton & Millville Traction Co., new car house			255
Springfield Railway Company			9,853
Chicago & Joliet construction			91,563
Cash on hand			37,639
			$3,873,939

Liabilities		
Capital stock	$3,750,000	
Bills audited, but not paid	9,268	
Accident insurance fund	5,221	
Balance due sub-companies	14,465	
Accounts payable	247	
Profit and loss, surplus as per operating report	94,736	
		$3,873,939

Annual Reports of the Chicago Elevated Railroad Companies

The annual reports of the Chicago elevated railroad companies for the year ending June 30 have just been made public. They show an appreciable increase in both gross and net earnings over last year's operation, and are generally considered satisfactory. The increase per cent in gross earnings of the Metropolitan is 19.5; of the South Side, 18.5; of the Lake Street, 11.4. The reports compare as follows as to earnings from operation:

	1899	1900
Metropolitan	$667,799	$868,321
South Side	421,332	527,544
Lake Street	333,281	343,216
Northwestern	.....	39,152
Total	$1,422,412	$1,778,233

The percentage of operating expenses to gross receipts on the Metropolitan was 55.6; on the South Side, 56.6; on the Lake Street, 66.1.

The Metropolitan report shows:

	1899	1900
Gross receipts	$1,291,697	$1,550,409
Operating expenses	623,898	682,088
Maintenance of way and structure	27,830	34,021
Maintenance of equipment	59,952	89,918
Conducting transportation	461,676	487,220
General	74,440	70,929
Earnings from operation	$667,799	$868,321
Receipts from other sources	45,102	53,052
Net income	$712,901	$921,373
Fixed charges	371,141	618,517
Interest	* 155,368	378,320
Rents	150,003	157,890
Taxes	56,275	52,000
Miscellaneous	9,495	30,309
Net earnings	$341,760	$302,856
Dividends	.....	217,952
Surplus	† $341,760	$84,904

* Part of year only. † Of this, $76,980 was the surplus of the new corporation, the Metropolitan West Side Elevated Railway Company, from the beginning of its operations, Feb. 2, 1899, to June 30, 1899.

The South Side Elevated report shows:

	1899	1900
Gross receipts	$1,026,270	$1,217,493
Operating expenses	* 604,938	689,949
Maintenance of way and structure	39,720	48,623
Maintenance of equipment	65,780	93,569
Conducting transportation	455,600	498,612
General	43,838	49,145
Earnings from operation	$421,332	$527,544
Receipts from other sources	37,476	40,886
Net income	$458,808	$568,430
Fixed charges	99,525	57,858
Interest	33,750	33,750
Taxes	26,108	22,332
Other	39,667	1,776
Net earnings	$359,283	$510,572
Dividends	103,238	361,333
Surplus	$256,045	$149,239

* Includes loop rental.

The Lake Street report shows:

	1899	1900
Gross receipts	$639,340	$713,475
Operating expenses	306,059	370,259
Maintenance of way and structure	10,741	11,608
Maintenance of equipment	25,481	31,803
Conducting transportation	240,104	290,336
General	29,733	36,512
Earnings from operation	$333,281	$343,216

Receipts from other sources	13,959	14,112
Net income	$347,240	$357,328
Fixed charges	341,649	373,957
Interest	261,444	262,769
Rents	66,753	100,009
Charges	13,452	11,179
Net earnings	$5,591	* $16,679

* Deficit.

The Northwestern report shows:*

Gross receipts	$65,487
Operating expenses	26,335
Maintenance of way and structure	627
Maintenace of equipment	1,318
Conducting transportation	21,590
General	2,800
Earnings from operation	$39,152
Receipts from other sources	.....
Net income	$39,152
Fixed charges	29,097
Interest (30½ days)	20,925
Rents	6,506
Taxes	1,666
Net earnings	$10,055

* From May 31 to June 30.

Train to the Kansas City Convention

The committee on transportation to the Kansas City Convention has issued the following revised circular regarding train accommodations:

SPECIAL NOTICE! REVISED CIRCULAR!

The committee begs to advise that they have arranged with the New York Central & Hudson River Railroad for the accommodation of delegates and others, attending the above convention, as follows:

Leave New York	N. Y. C.	10.00 A. M.	Sunday,	October	14th.
" Poughkeepsie	"	11.45 A. M.	"	"	"
Arrive Albany	"	1.20 P. M.	"	"	"
Leave Albany	"	1.30 P. M.	"	"	"
" Schenectady	"	2.00 P. M.	"	"	"
" Utica	"	3.40 P. M.	"	"	"
" Syracuse	"	5.05 P. M.	"	"	"
" Rochester	"	6.50 P. M.	"	"	"
Arrive Buffalo	"	8.35 P. M. (E. T.)	"	"	"
Leave Buffalo	L. S. M. S.	7.40 P. M. (C. T.)	"	"	"
" Erie	"	9.40 P. M.	"	"	"
" Cleveland	Big Four	12 10 A. M.	Monday,	October	15th.
" Indianapolis	"	8.00 A. M.	"	"	"
Arrive St. Louis	"	1.50 P. M.	"	"	"
Leave St. Louis	Wabash	2.15 P. M.	"	"	"
Arrive Kansas City	"	9.20 P. M.	"	"	"

The train will consist of baggage, smoking and Pullman vestibuled drawing room sleeping cars, and dining car serving meals through to Kansas City. A special representative of the New York Central will accompany the party to Kansas City.

RATES OF FARE

Special rate of one and one-third fare on the certificate plan has been made, and delegates, when purchasing tickets, should ask ticket agent for certificate which, on presentation at Kansas City, will secure one-third fare for the return trip. Sleeping cars at regular rates.

The committee in charge would respectfully urge that all who take the train at New York, or stations on the New York Central & Hudson River Railroad, communicate with Milton C. Roach, general Eastern pasenger agent, New York Central & Hudson River Railroad, 1216 Broadway, New York, stating exact accommodations required and from what point.

Reservations will be made in order as received, and prompt notification of assignment made to applicant.

PROTECT YOUR ROAD
The use of the Wilson Trolley Pole Catcher protects your road against needless loss and damage.
The loss is the loss of time by delays; the loss of fares through the destruction of the conductor's attention; the loss from injuring passengers and passers-by with flying trolley ropes.
The damage is the actual injury to harps, trolley poles, and overhead construction, which nearly always happens when the pole leaves the wire while the car is going at a high speed.
All this needless expense amounts in a year to more than the cost of equipping your entire line with the Wilson.
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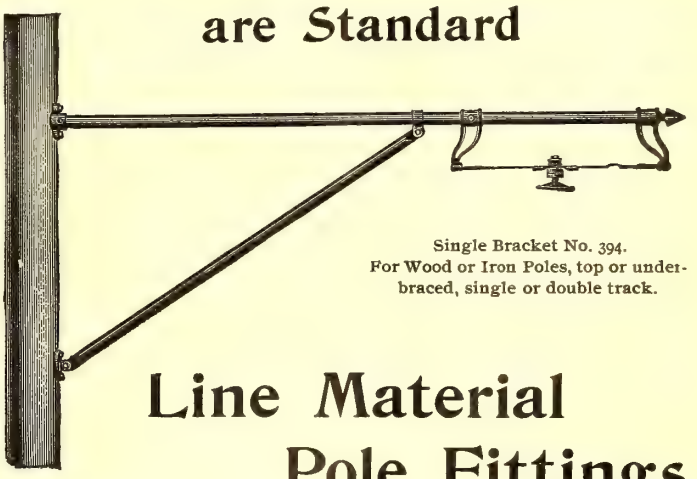

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New York	$31.75	$7.50
Poughkeepsie	30.75	7.50
Albany	30.25	7.00
Schenectady	30.00	7.00
Utica	29.25	6.50
Syracuse	28.62	6.00
Rochester	27.02	5.50
Buffalo	26.00	5.50

Money can be remitted to Mr. Roach direct.

Members of the association and their friends, starting from Boston and points on the Boston & Albany Railroad, should arrange to take regular train leaving Boston at 10:45 a. m., Sunday, Oct. 14, reaching Kansas City early Tuesday morning.

Application for space should be addressed to J. L. White, passenger agent of the Boston & Albany Railroad, 366 Washington Street, Boston, Mass.

The committee would respectfully suggest that delegates and their friends should make early arrangements. Applicants should address or call on ticket agent, Wabash Railroad, at Kansas City, for the return trip.

H. H. VREELAND, Chairman.
JAMES H. MCGRAW,
CHARLES W. PRICE,
T. C. MARTIN,
Committee for New York.

CHAS. S. CLARK, Committee for Boston, 8 Oliver Street, Boston.

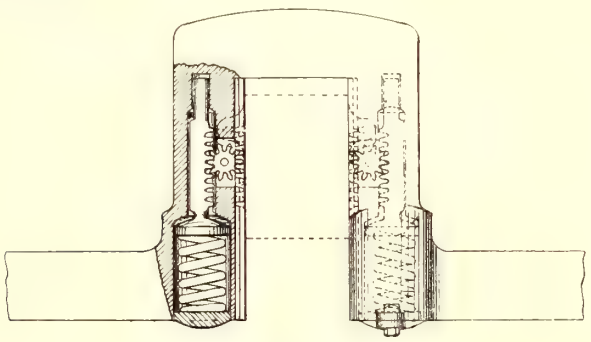
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

ELECTRIC RAILWAY PATENTS ISSUED SEPT. 25, 1900

658,355. Railway Track Structure; T. C. Du Pont, Johnstown, Pa. App. filed Dec. 1, 1899. A cast-steel track structure having its rail members provided with a joint or extension piece, consisting of a length of rolled rail and cast-steel splice-bars cast to and uniting the rail member to the rolled-rail length.

658,356. Railway Track Structure; T. C. Du Pont, Johnstown, Pa. App. filed Dec. 1, 1899. Consists of a railway track structure composed of a plurality of rails or rail sections properly fitted together and placed to form the particular structure in view and united by a central portion of hardened cast-steel case in place between and through the rail sections, and having its upper surface provided with flangeways and gage lines which align with those of the rails.



PATENT NO. 658,390

658,357. Rail Joint; T. C. Du Pont, Johnstown, Pa. App. filed Dec. 1, 1899. See preceding patent.

658,360. Railway Track Structure; E. B. Entwisle, Johnstown, Pa. App. filed March 19, 1900. Provides for removal and replacement of wear plates which are used to form the intersection portions of track crossings.

658,376. Railway Track Structure; C. F. Kress, Johnstown, Pa. App. filed March 19, 1900. See preceding patent.

658,388. Mechanism for Imparting Successive or Alternating Movements; E. Moore, Meductic, Canada. App. filed Nov. 15, 1899. Provides means for alternately shifting an electric current in order to operate the switch tongue of tramway switches.

658,390. Car Truck; E. G. Nicewaner, Johnstown, Pa. App. filed Jan. 8, 1900. Consists in seating the journal-box springs laterally of the journal boxes, and in so connecting them with

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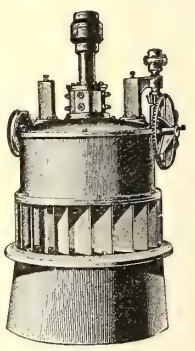

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Poles break where the decay begins—at the surface of the ground This decay comes from the outside, always, and should be stopped there.
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will kill decay at its source, and save the pole. It is not a mere coating, but actually penetrates and preserves.
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the said boxes that they receive by compression upward thrusts or movements of the boxes, and also the weight of the load, and thus cushion the effects thereof.

658,405. Railway Track Structure; P. G. Stormer, Johnstown, Pa. App. filed Dec. 1, 1899. See preceding patents on track structure.

658,445. Electric Car; A. A. Ingraham, Lowell, Mass. App. filed Oct. 2, 1899. Details relating to gearing and motor support.

658,448. Car Truck; H. R. Keithley, Buffalo, N. Y. App. filed April 4, 1900. Details of a truck, the side frames of which are constructed mainly of pressed steel.

658,449. Car Truck; H. R. Keithley, Buffalo, N. Y. App. filed June 22, 1900. See preceding patent.

658,525. Platform Car; E. C. Huse, Somerville, Mass. App. filed May 31, 1900. Designed for use in suburban express service. A platform car is provided with pivoted runways at its ends, whereby a loaded express wagon may be steadily drawn on the car for transportation. The runways may then be swung over the body of the car and serve as trigs for the wheels of the wagon.

658,530. Combined Wheel Fender and Emergency Brake; E. L. Requard and E. S. Merryman, Baltimore, Md. App. filed July 14, 1900. A pivoted frame normally held up away from rails and wheels, carries a fender and wedge-shaped blocks of steel toothed on under surface. When released, frame carries fender to proper place and toothed blocks engage and bite into upper surface of rails.

658,659. Car Truck; J. L. Levy, New York, N. Y. App. filed Sept. 14, 1897. Consists in framing an extension of the truck bolster, supporting it on the truck frame by links and equalizing bars, the links having a compression and recoil spring, and pivotally uniting the links with the truck frame and the links of the equalizing bars, so that both links, bars and bolster can swing transversely in union with the movements of the car body.

658,702. Car Fender; J. L. Conner, Washington, D. C. App. filed May 16, 1900. Structural details.

PERSONAL MENTION

MR. B. J. ARNOLD, of Chicago, who has been making an extensive trip abroad, will sail for New York on the Majestic, leaving Oct. 10.

MR. A. KUNDIG, who is associated with Mr. Stephen D. Field in the reconstruction of the Genoa, Switzerland Street Railway system, was married Sept. 10.

MR. CHESTER P. WILSON, lately of Milwaukee, expects to spend the next few months in Europe on a business trip. Mr. Wilson will sail Oct. 6, and will make his headquarters in London.

MR. A. B. SHEPARD, manager of the Cleveland branch of the General Electric Company, was married to Miss Gertrude Robbins, of New York City, at St. George's Church, New York, on Sept. 18.

MR. MARTYN WELLS, resident manager of the Calcutta Tramways Company, of Calcutta, India, who has been in this country inspecting the electric railway lines and studying American practice, sailed for London Oct. 3, on the Oceanic.

ENGINEERING SOCIETIES

THE ENGINEERS' CLUB OF PHILADELPHIA.—A business meeting of this club will be held on Saturday, Oct. 6, 1900, at 8 o'clock, p. m. A communication will be presented from the Engineers' Society of Western New York requesting the co-operation of the club in the establishment of a joint congress and engineering exhibit at the Pan-American Exposition, to be held in Buffalo, N. Y., from May 1 to Nov. 1, 1901. The desirability of bringing together, upon some annual occasion, the members and friends of the club, and their families, has received the favorable consideration of the board of directors. The suggestion has been made that the annual celebration of the organization of the club, which occurred on Dec. 17, 1877, might be inaugurated, and that such an occasion would be most fitting for an annual reunion as above indicated. It has been further suggested that the second Saturday of December of each year might hereafter be denominated "Founders' Day"; that the stated meeting of that date be held in a hall suitable for the convention indicated; and that the programme for these celebrations and annual reunions might consist of popular lectures, or such other suitable exercises as may be determined upon from time to time. The plan above indicated will be submitted to the club for its judgment and action. Prof. Fred. W. Gordon will deliver a lecture on "Transmission of Gas and Air Through Pipes; and the Transmission of Power by Compressed Air."

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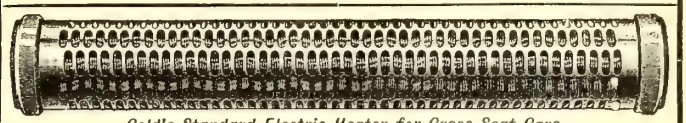

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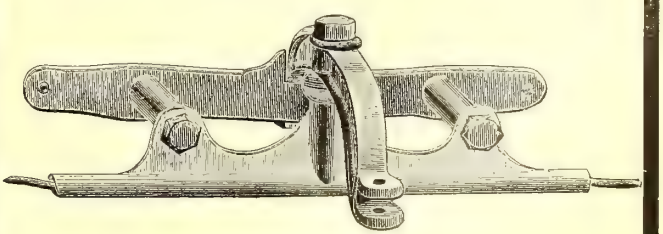

Our Columbia Patent Strain Line Anchor is used by many of the largest traction companies in the country. Can be used with any hanger or pull off. Does away with all pockets. Trolley wheel or pole cannot get caught. On single line is used with double shoe. Once tried, always used. Write for prices and particulars.

NEWS NOTES

[*News notes for this department are solicited.*]

BOSTON, MASS.—A special from Boston says that the Railroad Commissioners have informally notified the counsel of the Lynn & Boston Street Railway Company and Nathan Matthews, Jr., representing C. S. Cummings & Company, that the Board would refuse to authorize the issue of $1,500,000 additional capital stock until it had made inquiries as to the value of the road, its financial condition and its management. The investigation has already been started and will shortly be completed by the Board inspector, Mr. McLean, and by Appraiser Hodges. The Board further stated that in case the additional issue was allowed it would not allow the same to be sold at less than $125 per share.

WORCESTER, MASS.—The Worcester & Blackstone Valley Street Railway Company will shortly apply to the Railroad Commissioners for permission to carry baggage and freight on its lines. There is a general desire among the farmers of the suburban district served by the company's lines to have their milk brought to town on the electric railways. It is believed that this alone would prove profitable.

DULUTH, MINN.—The City Council of Superior has instructed the City Attorney to take immediate steps for the annulment of the franchise of the Duluth & Superior Traction Company, operating there. The alleged reason is that the company has failed to keep its agreement as to improving its system. The action of the Council is not taken seriously.

UTICA, N. Y.—The City Council has just passed an ordinance compelling all street railway companies operating cars in the city to equip them with fenders. The ordinance stipulates that this must be done by Nov. 1, and that failure to comply with this provision will result in a fine of $25 for each violation.

SYRACUSE, N. Y.—The Archbold-Brady Company, of this city, has just been incorporated, with a capital stock of $50,000. The company will do a general contracting business, and will make a specialty of constructing street railways, lighting plants, etc. The directors of the company are: William K. Archbold, of New York; Paul T. Brady and Robert E. Drake, of Syracuse.

PHILADELPHIA, PA.—The J. G. Brill Company is now constructing seventy-five convertible cars for the International Traction Company, of Buffalo. It is expected that the cars will be ready for delivery in December.

SEATTLE, WASH.—The Seattle Electric Company will shortly concentrate its operating and office force, and has engaged offices in Holyoke Block, which it is now preparing to occupy. The company will occupy two floors and the basement of the building. The new transfer system, which was inaugurated on Sept. 5, has proved popular with the riding public.

SEATTLE, WASH.—Control of the Seattle-Tacoma Railway Company has passed into the hands of Jacob Furth, of Seattle; George B. Blanchard, of Tacoma, and Eastern capitalists. A new board of directors and new officers have been elected, the new officers being as follows: Jacob Furth, president; George B. Blanchard, vice-president and manager; W. C. Forbes, of Boston, treasurer. Mr. Furth states that it is the intention of the company as now organized to put engineers in the field with a view of examing the several routes that have from time to time been proposed, and that a careful examination will be made before finally determining on the route to be selected. Mr. Blanchard will have charge of the active work of the company, and he will begin examining the ground without delay. As soon as a definite route is decided on, construction will be resumed and prosecuted with as little delay as possible. The Seattle-Tacoma Railway Company was organized in the spring of 1899, Henry Bucey, of Tacoma, being the active organizer. With him were associated John Collins and Andrew Chilberg, of Seattle, and H. E. Knatvold and Samuel Wilkinson, of Tacoma.

CONSTRUCTION NOTES

[*Information regarding the building of new roads, enlargements of power plants, extensions, etc., will be much appreciated.*]

SAN FRANCISCO, CAL.—Plans looking toward the abolition of cable and the substitution of electricity on all the lines of the Market Street Railway Company in Western and Richmond districts, have been presented to the directors by Superintendent of Construction Henry J. Lynch, and will doubtless be accepted. Remodeling involves the expenditure of $500,000.

DES MOINES, IA.—The Des Moines Street Railway Company is replacing the old rails all over its lines in the business portion of the city with new and heavier rails. The company is also constructing a loop, which will run by the main entrance of the Union Depot, and over which all cars will run. The company has put extra cars on several of its lines this fall, in order to expeditiously handle the increase in traffic. It is said that the company proposes to begin the construction of the new line from Valley Junction to Greenfield at once.

HAVERHILL, MASS.—The Lowell, Lawrence & Haverhill Street Railway Company has just been granted a franchise for the extension of its lines from Ward Hill to the North Andover line.

BROCKWAY, MICH.—Gill R. Lovejoy, of Mount Clemens, and J. E. Weter, of Richmond, are here securing the right of way for the new Richmond & Sanilac Center Electric Railway, and will go north from Richmond, striking the following towns: Memphis, Emmet, Brockway, Yale, Speaker, Peck and Sanilac Center.

ALBION, MICH.—The City Council has granted the Kalamazoo Valley Electric Railway Company a thirty-year franchise. The franchise has been hanging fire for two years, and was recently passed by the Council, but vetoed by the Mayor. The present franchise compels the company to run the road through Main Street if grade crossings can be secured over the L. S. & M. S. and M. C. Railroad tracks.

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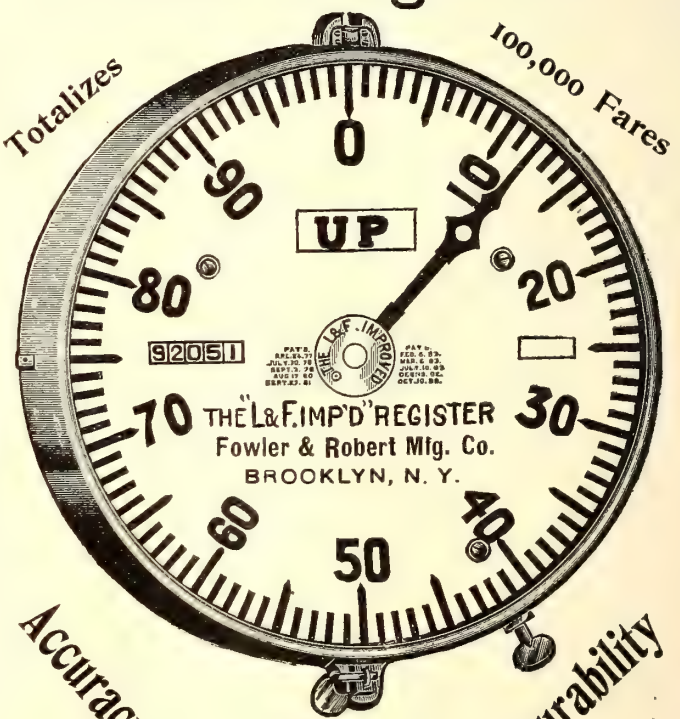

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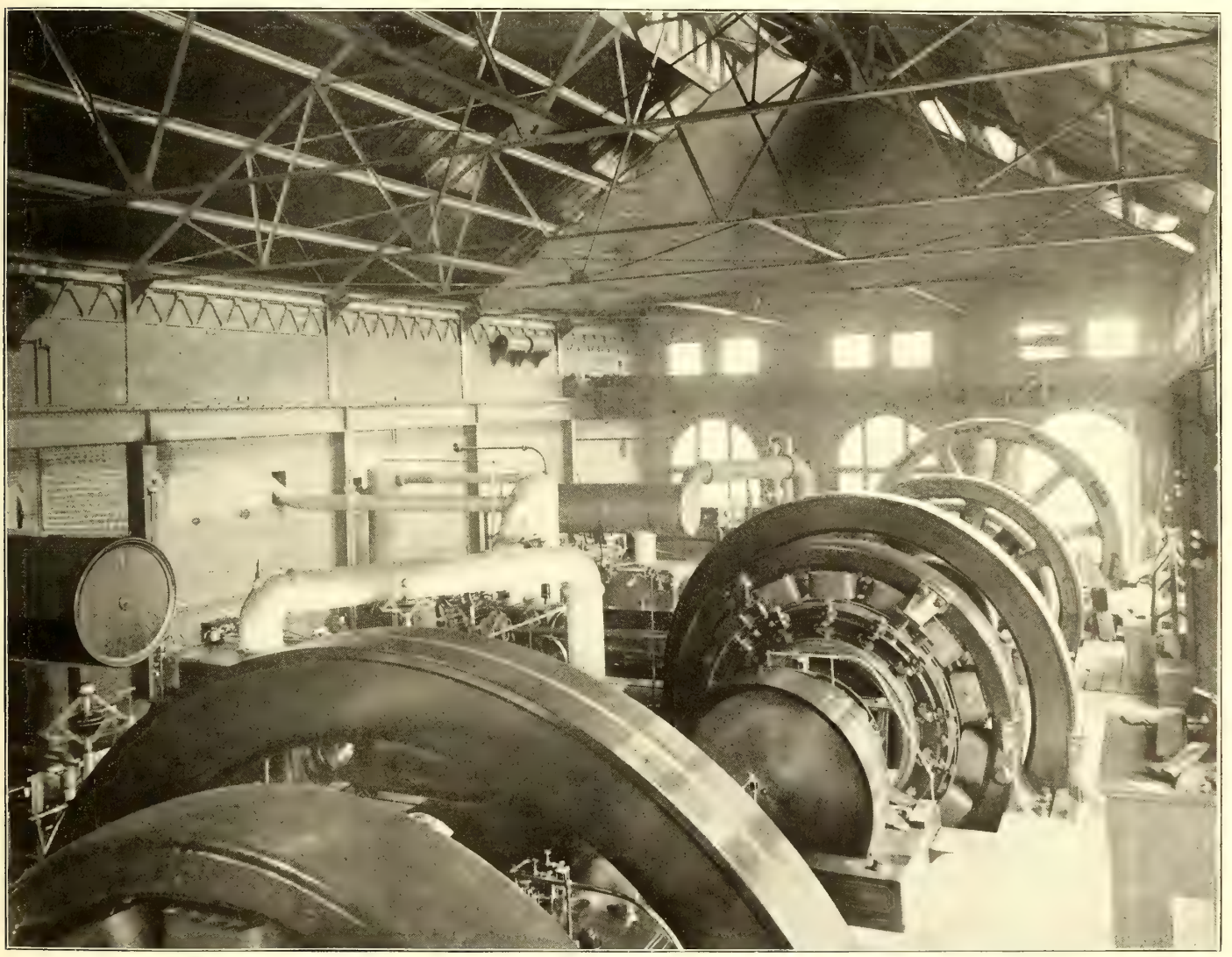
Street Railway Journal

Vol. XVI. NEW YORK AND CHICAGO, OCTOBER 13, 1900. No. 41.

THE STREET RAILWAY SITUATION IN THE TWO KANSAS CITIES

The unique topographical and other peculiar conditions of Kansas City have made the construction and operation of its street railway systems an unusually complex problem, and have developed many novel solutions of the problems presented. Forced by the very difficulties of their situation to adopt the very latest advances in the art of surface traction or to invent their own improvements on standard practice, the street railways of Kansas City have been as progressive as any in the continuous process of evolution of the last few years, and are now behind none in the application of the very latest improvements to apparatus and methods.



GENERAL VIEW OF KAW RIVER STATION, METROPOLITAN STREET RAILWAY CO.

Kansas City is located just on the State line between Kansas and Missouri. This line divides the city into two separate cities, with independent city governments. The larger of the two, and the one containing the business center and the best residence districts, is Kansas City, Mo.; the other, Kansas City, Kas., contains less expensive dwellings. The population of the two, as given in the United States Census for 1900, is 215,000.

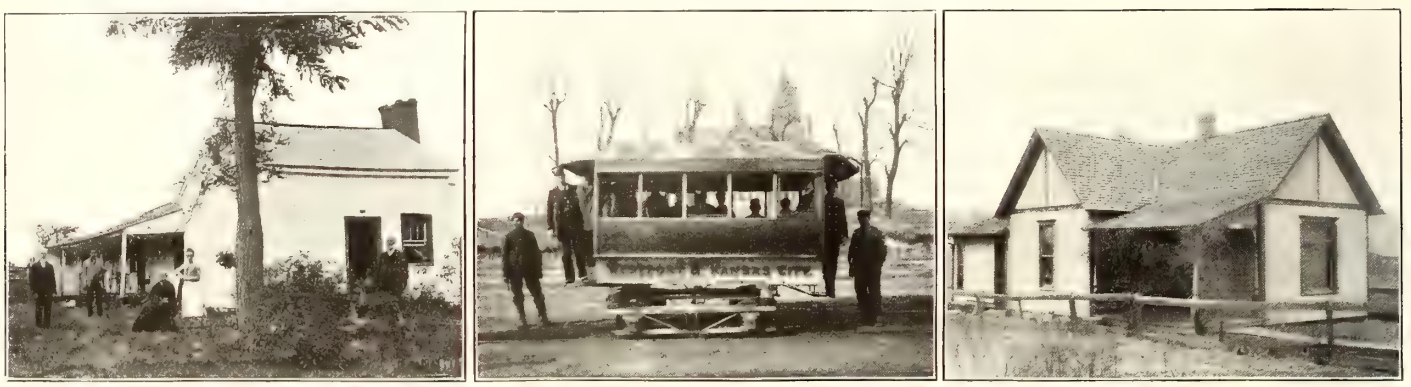
THE CHIEF INDUSTRIES OF KANSAS CITY

The city is fundamentally a great railroad center, serving as a collecting, jobbing and distributing point for the highly cultivated agricultural sections of Kansas, Nebraska, the Indian Territory, Colorado and the western part of Missouri. As these States and those further south and west are to a large extent engaged in the raising of live stock, Kansas City's greatest and most conspicuous

A TYPICAL GRAZING SCENE NEAR KANSAS CITY

industry is stock yards and their accompanying slaughtering and packing houses. Kansas City now ranks second only to Chicago in the volume of business in this line, and with the growing advantages of transportation of meat in refrigerator cars, as compared with the transportation "on the hoof," expects soon to rank ahead of Chicago.

It may be well to remark here that, in common with other Western cities, Kansas City's expectations are very great. Enthusiastic local patriotism, the outcome of rapid growth and development, is a strong characteristic of her citizens, all of whom are more or less imbued with the idea that "Kansas City has the brightest and most glorious future of any city on earth."



SOME HISTORIC VIEWS IN AND AROUND KANSAS CITY

THE TOPOGRAPHICAL CHARACTER OF THE CITY

The most noticeable feature of the city from a street railway point of view is its extremely irregular profile. Along the bank of the river are low bottom lands, which are frequently flooded at times of extreme high water. The greater part of the city is located on high bluffs, the elevation of which averages about 150 ft. above the low lands. The whole area occupied by the city was originally a series of sharp hills and deep gulleys, cut by rushing brooks through the clay soil down to the limestone substratum. These have required extensive cutting and filling to get serviceable real estate, and in spite of this cutting and filling the city remains a series of hills and valleys both north and south and east and west. An idea of the inclinations of the present streets can be obtained from profiles of several of the street railway lines, given on one of the following pages. The Eighth and Ninth Streets lines run east and west, while the Holmes Street line runs north and south.

The whole city lies south of the Missouri River, there being no opportunity for growth on the other side owing to the great width there of bottom lands, which are so frequently flooded as to render them uninhabitable. The river sweeps around a curve in front of the city, as is shown

COLLISION BETWEEN TWO FREIGHT TRAINS, ARRANGED FOR THE AMUSEMENT OF KANSAS-CITIANS

THE NEW AUDITORIUM

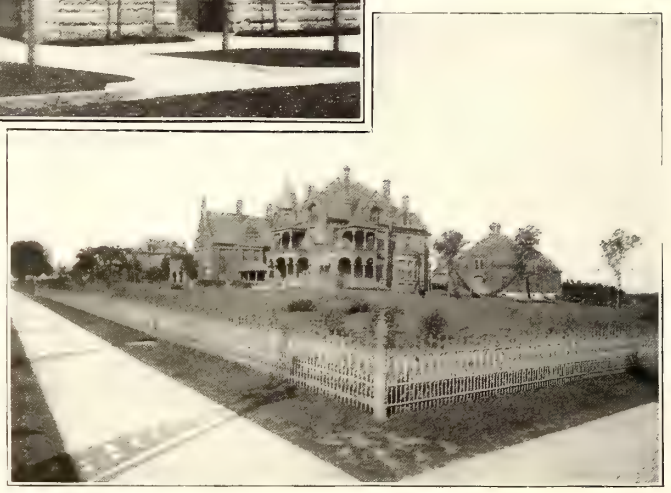
BOARD OF TRADE BUILDING

OLD AUDITORIUM THEATER

in the map, and threatens to cut across the low lands at any time and short-circuit this curve, leaving the city inland. Through Kansas City, Kan., there flows the Kansas or Kaw River, which must be crossed at several points to give access to the greater part of the Kansas portion of the city. No street railway lines whatever cross the Missouri, there being no population on the north side of the river.

In the low lands lying along the Kaw River, near its junction with the Missouri, is the Union Depot district, containing the depot—into which run almost all of the twenty-five railroads centralizing in Kansas City—as well as the stock yards with a large number of their employees. The district also contains many large jobbing houses, handling agricultural implements and other wares. To reach the business center from this low district or from Kansas City, Kan., which is west of it, it is necessary to surmount a high ridge, which is clearly indicated in the profile of the Ninth Street line. On the other side of this ridge is a hollow or valley, through which run some of the principal streets, and from which it is again necessary to rise to reach the residence section of the city. It is interesting to compare this profile of the Ninth Street line with that of another line also running to the Union Depot, but being elevated in the low lands and tunneling under the high ridge between the low lands and the depression, in which lies the business center. This line, with its lower

A VIEW IN THE STOCK YARDS



GROUP OF KANSAS CITY RESIDENCES

grades, is that on Eighth Street, the profile of which is shown below that of Ninth Street.

On account of these heavy grades the street railways in Kansas City have been largely operated on the cable system, although these cables are now being displaced by electric motors on all of the lines but two, the Ninth and Twelfth Street, on which the grades are so severe that cables are necessarily maintained. In fact Kansas City was for a long time the stronghold of the cable system in this country, ranking with San Francisco in point of mileage operated in this way. Before any lines were changed from cable to the electric system there were 63 miles of track operated by cables.

A BRIEF HISTORY OF KANSAS CITY AND ITS RAILWAY SYSTEM

Originally Kansas City was simply the river port town of Westport, now one of its residential districts. The real growth of Kansas City began about 1870; at that time Leavenworth, 25 miles further north on the Missouri River, was then the important river town, but as the latter place did not offer sufficient inducements to several railways building toward the Missouri River, they turned to the site of Kansas City as the crossing point. In earlier years the Missouri River traffic was an important element of the city's commerce, but the improvements of rail transportation have reduced this to a small factor. Some views of the early period of the city's history are given on a preceding page. The middle view is of the first street car operated; the left and right hand views, the homes of Jesse James, father and son. The growth since that time has been remarkably rapid, subject only to the usual ups and downs of good and bad times in the West. In 1885 and 1886 the city underwent a phenomenally vigorous "boom." It was then jocularly said of Kansas City that it was advisable to build residences on wheels in order that they might be easily moved from time to time out of the way of the advancing business section. In 1893 and following years the industrial depression generally felt throughout this country, and especially in the West, fell particularly heavy upon Kansas City, but the improved industrial conditions of the last few years with the good crops raised in the territory tributary to Kansas City have brought a revival of good times and a renewed but more healthy growth.

KANSAS CITY CLUB

The first horse car line in the city was started in 1871 between Kansas City and Westport, by Nehemiah Holmes, father of the Holmes brothers, now respectively president and general manager of the Metropolitan Street Railway Company. In order to convert this into a cable line and to build other lines, the Grand Avenue Cable Railway Company was incorporated on March 27, 1886. Another system of mule car lines was started in 1874 by a man familiarly known in Kansas City as Tom Corrigan. Five or six lines were built and operated frugally and shrewdly. The cable line built up Ninth Street by the Kansas City Cable Railway Company demonstrated the advantage of the cable over the horse system, but the Corrigan interests were unable to finance a change as expensive as the installation of cables, and in 1886 the Metropolitan Street Railway Company was organized to take over the system of the Corrigan Consolidated Street Railway Company and convert it into a cable system. The horse car lines were most antiquated in equipment, but were sold for $1,000,000 in 5 per cent first mortgage bonds. The Metropolitan Company has gradually absorbed nearly all of the other street railway

RUINS OF CONVENTION HALL

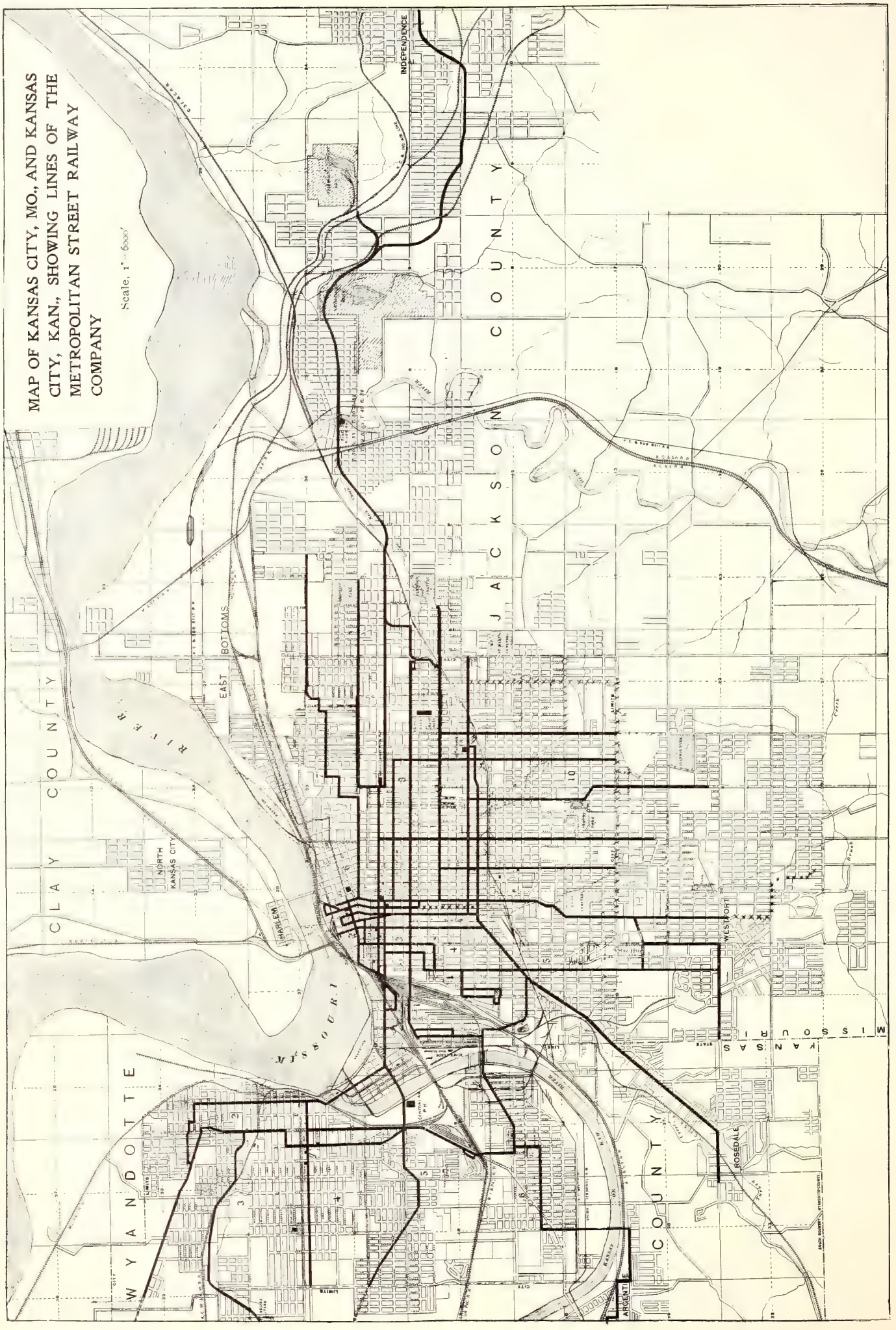
THROWING WATER ON CONVENTION HALL FIRE

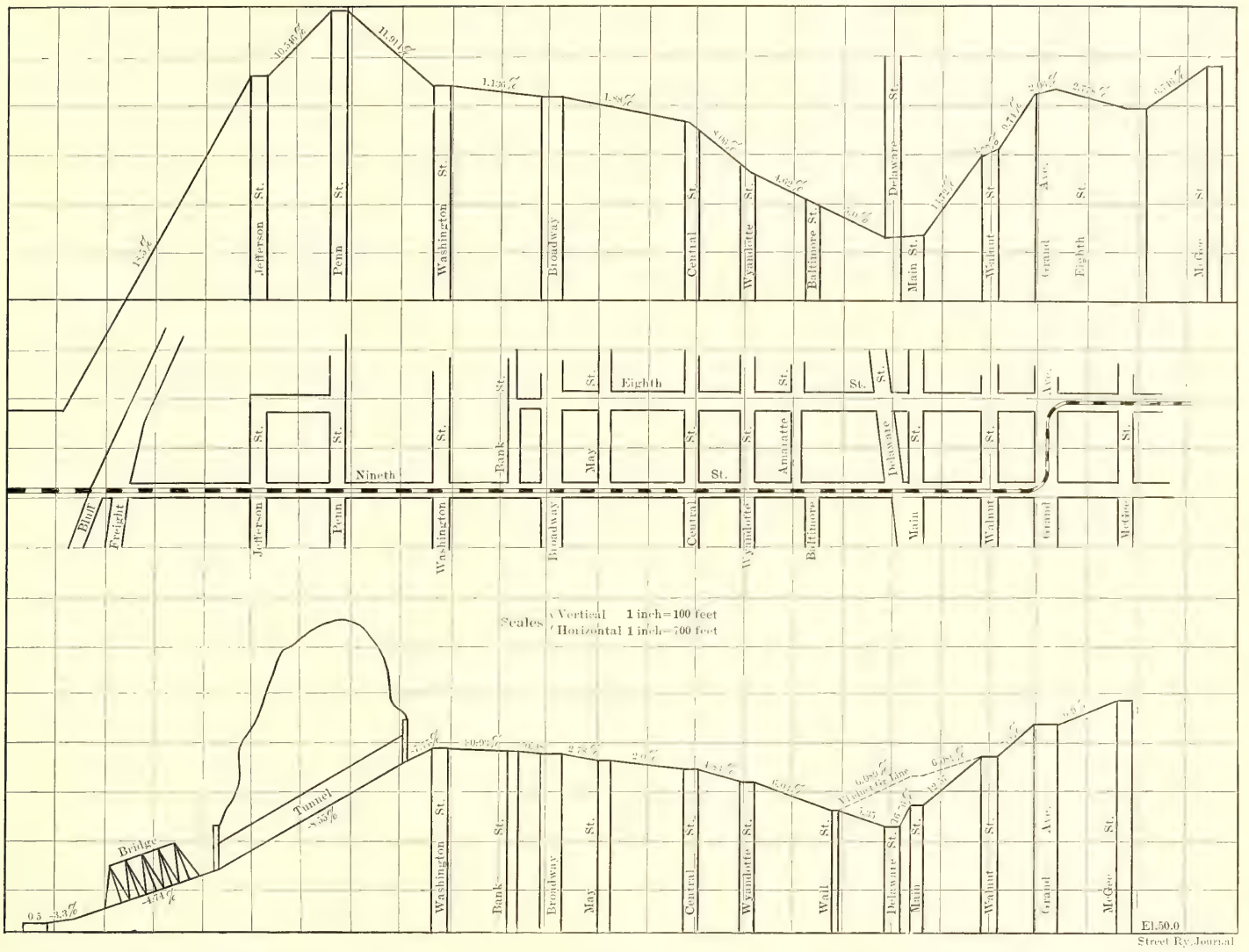
properties in the two Kansas Cities, having taken over the elevated railway in 1894, the Kansas City Cable Railway and Grand Avenue Cable Railway and others in 1895, and others since. The only line in Kansas City which it does not control is the East Side Electric Railway, running along the low lands near the river, and built by a brewing establishment, more to reach their brewery than for any other purpose. In addition to this there is an interurban line, the Kansas City-Leavenworth Line, which is not associated with the Metropolitan system. Otherwise, the twenty lines in the city, with an aggregate length of 160 miles of track, are all operated by the Metropolitan Street Railway Company.

THE PRESENT SYSTEM OF THE METROPOLITAN STREET RAILWAY COMPANY

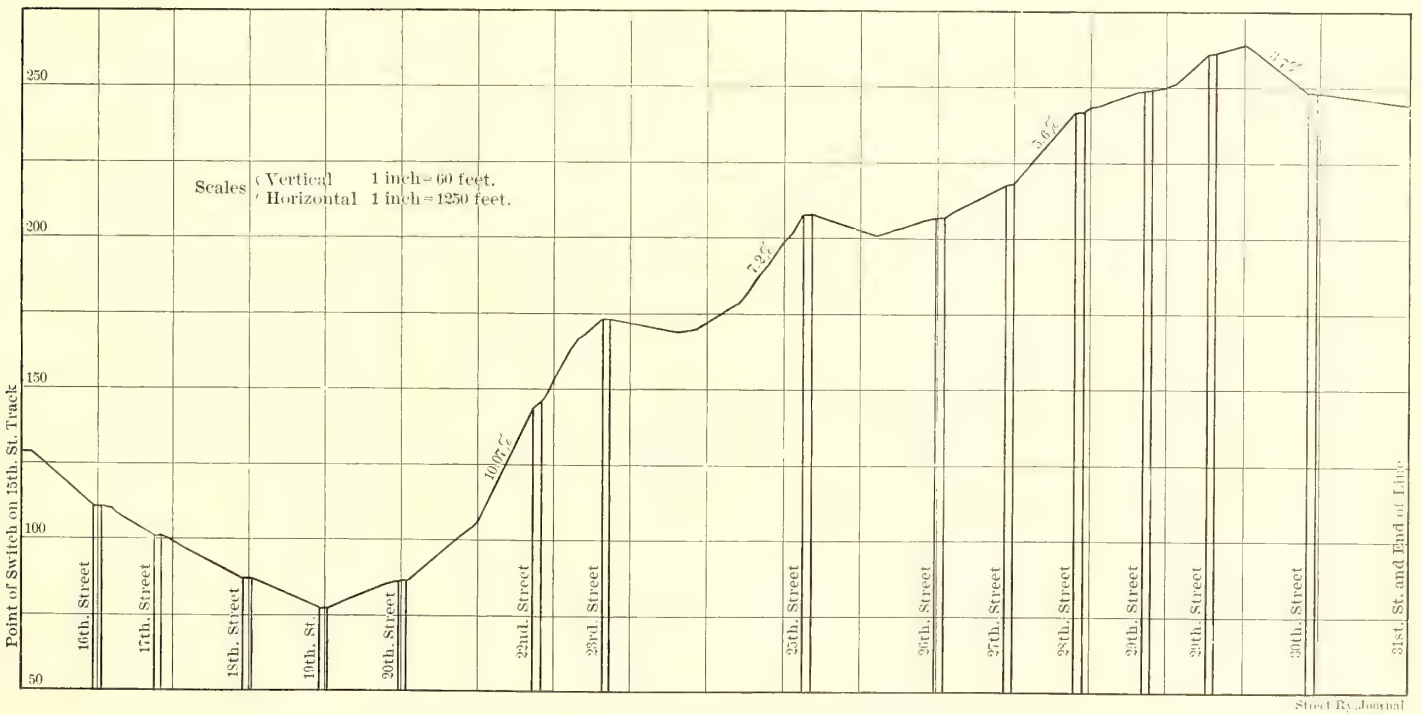
Kansas City is laid out, as a reference to the map will show, on what is generally known as the Philadelphia system. The intersecting streets are, as a rule, at right angles

NINTH STREET VIADUCT, LOOKING EAST FROM UNION DEPOT


MAP OF KANSAS CITY, MO., AND KANSAS CITY, KAN., SHOWING LINES OF THE METROPOLITAN STREET RAILWAY COMPANY
Scale, 1"=6000'
CLAY COUNTY
JACKSON COUNTY
WYANDOTTE COUNTY
INDEPENDENCE
EAST BOTTOMS
NORTH KANSAS CITY
HARLEM
WESTPORT
ROSEDALE
ARGENTINE
MISSOURI
KANSAS
MISSOURI RIVER
KANSAS RIVER



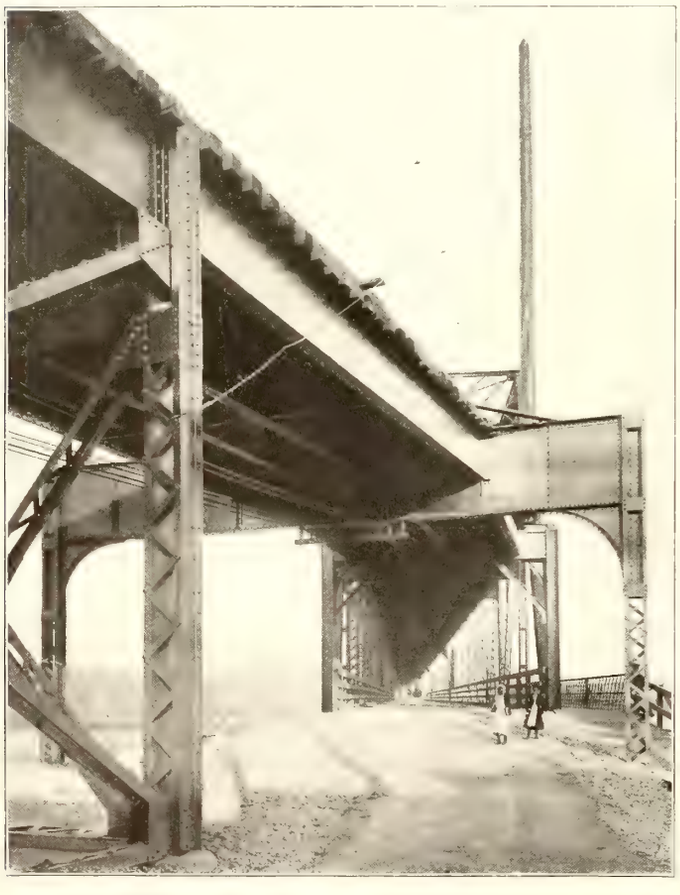
PROFILES OF EIGHTH STREET AND NINTH STREET LINES, SHOWING DIFFERENCES IN GRADES SECURED BY THE CONSTRUCTION OF THE TUNNEL AND VIADUCT ON EIGHTH STREET



PROFILE OF HOLMES STREET LINE, RUNNING NORTH AND SOUTH

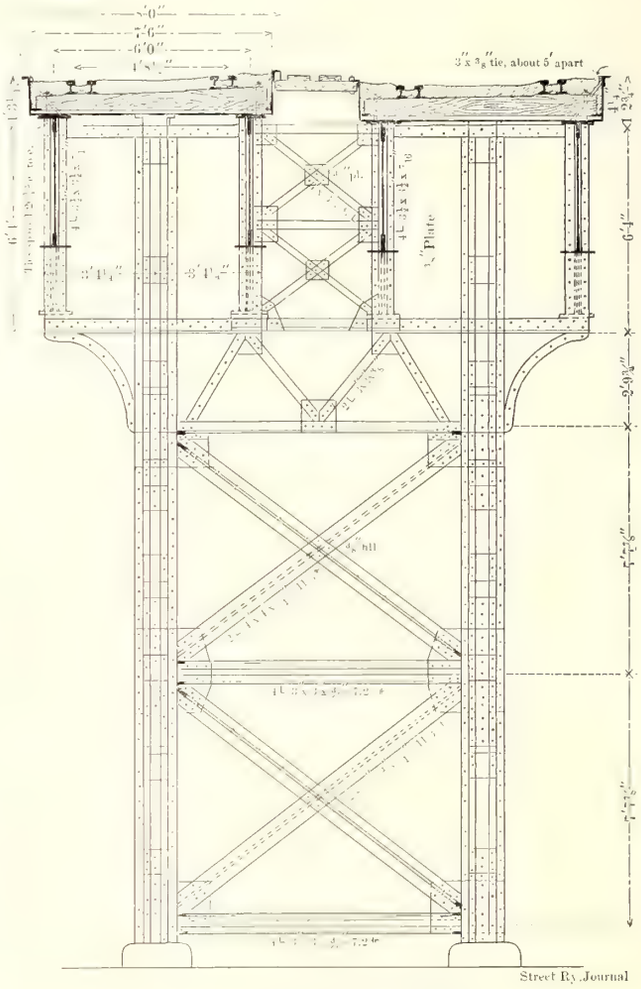
to each other, and at regular distances apart. All streets running east and west are numbered, beginning at the river, and one hundred numbers are assigned to the buildings in each square; the streets running north and south are named and not numbered. The principal business streets in the city are: Main, Walnut and Grand Avenue. The greater part of the traffic of the Metropolitan Street Railway system converges at the post office corner, Walnut and Ninth Streets, where a constant succession of loaded cable trains comes up the 15 per cent grade from the direction of Union Depot, or descends the same grade toward the depot, these cars transferring a large number of their passengers to and from the lines running north and south on Walnut Street. Transfers are given generally on the Metropolitan system at about eighty-five points of intersection, so that any part of the city can be reached from any other part for a single fare. The company is now using about 70,000 transfers per day, that is about 25,000,000 annually, about half of its passenger receipts being represented by transfers.

Practically all traffic to Kansas City, Kan., goes down past the Union Depot, either on the elevated road or on the surface electric line, which runs under it in the low lands and swings around the hills by a rather circuitous route to the business center. The elevated line was orig-



ELEVATED STRUCTURE, METROPOLITAN STREET RAILWAY

inally operated by steam locomotives. The grade of 8½ per cent up through the tunnel was overcome by a grip car, which took the trailers from the steam locomotives. At present this grade is easily surmounted by the electric cars, as the rails in the tunnel are always dry. Before the present year the electric cars coming up from the elevated through the tunnel were unable to reach the main business section on Walnut Street and Grand Avenue and the district east of it. To overcome this difficulty a viaduct has been built in Eighth Street, bridging the valley through which run Delaware and Main Streets, as illustrated in the profile already referred to. By means of this viaduct, the tunnel and the elevated over the low lands, this route presents a much more level profile than is presented by the Ninth Street line, which closely



TYPICAL BENT IN VIADUCT

follows the surface, and is subject to such heavy ups and downs that electric cars cannot be run on it. Toward the southern and eastern directions from the business center the company's cable and electric lines form a regular gridiron through the residence districts, the grades being less severe in this part of the city, so that cable or even electric lines can be operated with no difficulty.

As noted above, the twenty lines of the Metropolitan system have an aggregate length of about 160 miles, of which about 120 miles are operated electrically, the remaining 40 miles being cable driven. About 23 miles of lines formerly cable driven had been, previous to the present year, changed over to the electric system, and during last summer more of the remaining 40 miles of cable road were being prepared for the change. Several new lines, with an aggregate length of about 15 miles, are also under construction at the present time.

THE INDEPENDENCE LINE AND FAIRMOUNT PARK

In the eastern end of the city there is a road about 9 miles long, running from a depot at Fifteenth and Askew Avenue, out across the Blue River, past Washington Park, to the suburb of Independence, with a spur to Fairmount

VIEWS IN PASEO PARK

Park. This road runs largely on a private right of way, and was originally a steam line, operated by the Kansas City & Independence Railway Company. It was purchased by the Metropolitan Street Railway Company in 1895, and is now operated electrically to accommodate the suburban traffic to and from Independence, a place of about 12,000 inhabitants, and to carry passengers to and from Fairmount Park—which is operated by the Fairmount Amusement Company, a corporation closely associated with the street railway company. The park, which was originally laid out by a steam railroad, covers about 250 acres, and is located about 10 miles from the center of the city.

The Independence line get its traffic from the Fifteenth Street line, from which it starts, and also from the Twelfth Street and Ninth Street cable lines, which it intersects. The rates charged are 15 cents for the round trip from the depot to the park, without transfers, making the total cost per round trip from any other part of the city 25 cents. Thirty-minute service is given regularly, with greater frequency on Sundays and holidays. Some twenty-five to twenty-eight 45-ft. cars of the type illustrated herewith are run to Fairmount Park, five more cars being in continuous operation to Independence. These cars are driven by G. E. 1200 or G. E. 57 motors, two per car. The park is equipped with the usual attractions—summer theater, boat house, bathing facilities, etc., which are leased by the Fairmount Amusement Company.

Another park also reached by this street railway system is Troost Park, which lies on the Vine Street line, and near the Troost Avenue line. This park is leased by the Kansas City Park Diversion Company, which is closely associated with the street railway company. The park, which is located about 3 miles from the center of the city, covers about forty acres. Music is furnished by an orchestra, and on account of the convenience and low cost of access to this park large crowds attend it on good days, requiring at times from forty to fifty cable trains to handle them.

TRACK CONSTRUCTION IN KANSAS CITY

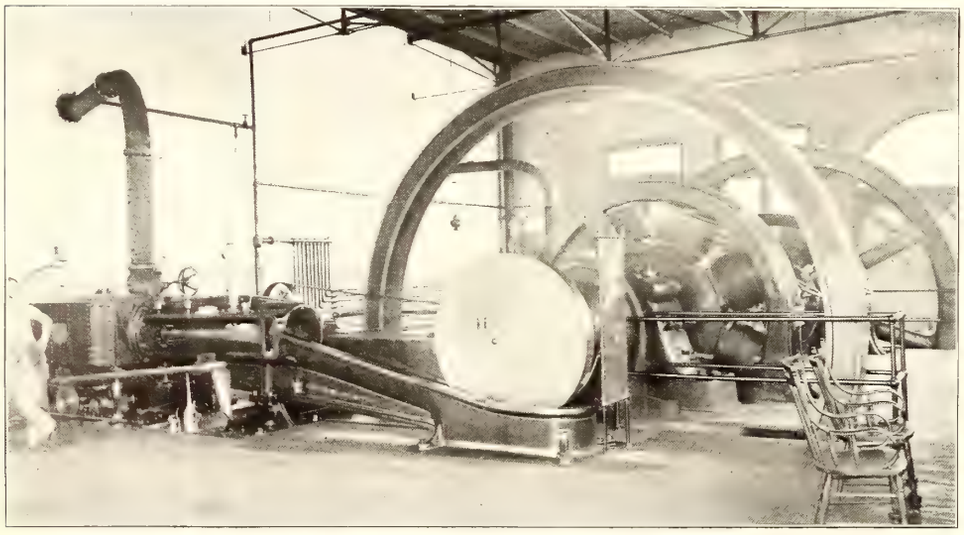
Practically all of the tracks in Kansas City are laid with center-bearing rails—with the ball of the rail above the street level—the companies never having been compelled by city ordinance to use side-bearing rails. Some side-bearing rails have been put in, but have given trouble through tipping outward. All tracks recently laid are 103-lb. 60-ft. center-bearing girder rails, made by the Lorain Steel Company. In the asphalted streets of the downtown district the construction described by Mr. Butts at the Chicago convention, and illustrated on page 795 of the STREET RAILWAY JOURNAL for November, 1899, is used; the rails

CABLE TRAIN ON TWELFTH STREET LINE

being bedded in a concrete stringer about 15 ins. deep from the top of the rail, and about 20 ins. wide over all. No ties or tie-rods whatever are used in streets which are asphalted from curb to curb, the rails being held to gage by

CAST-WELDING JOINTS

the non-movable character of the street paving. Where the street is not asphalted outside of the tracks tie-rods are used to hold the rails to gage. It is claimed that this bedding of the rail in concrete considerably reduces the leakage of current from the rail to ground, and hence reduces danger of electrolysis of rails and underground piping. The construction is a simple one, a trench of the proper size for the concrete stringer being dug for each rail. The rail is then supported temporarily on wooden blocks, and the trench is filled with concrete, which is tamped tight about and under the rail. The rails are toothed on both sides with granite blocks to protect the pavement from wear. The company is obliged to pave between its rails and between its tracks, but is not obliged to pave any part of the street outside of its tracks. Brick paving is used between the



INTERIOR OF INDEPENDENCE STATION

tracks to a considerable extent, and in some cases between the rails, but at the latter place trouble is occasionally caused by frost raising the brick paving until it strikes the motors. All the cable lines are paved with stone. Where the concrete stringer construction described above is not used the various forms of track construction on wooden ties shown in the cut are made use of according to whether the pavement is of brick or asphalt.

The joints throughout the entire system are to a large extent cast-welded, this work having been done by the Falk Company, which has also laid a large amount of track, and particularly of elaborate special work for the Metropolitan Street Railway Company during the last two or three years. Not only are the tracks of the electric lines and the cable lines, which have been converted into electric service, cast-welded, but cast-welds have also been put in on some of the cable lines where, of course, their electrical conductivity is of no value, the sole purpose being to preserve the joints. Cast-welds are not used on special work, which is all carefully bonded up to reduce the resistance of the re-

BLUE RIVER POWER STATION, INDEPENDENCE LINE

turn circuit. The North American Railway Construction Company has also done a large amount of cast welding and special work installing. The cast-welded joints have been found very satisfactory on the 6-in. and 9-in. sizes of rails, but have not been found satisfactory, owing to breakages, on the lighter $4\frac{1}{2}$-in. rails.

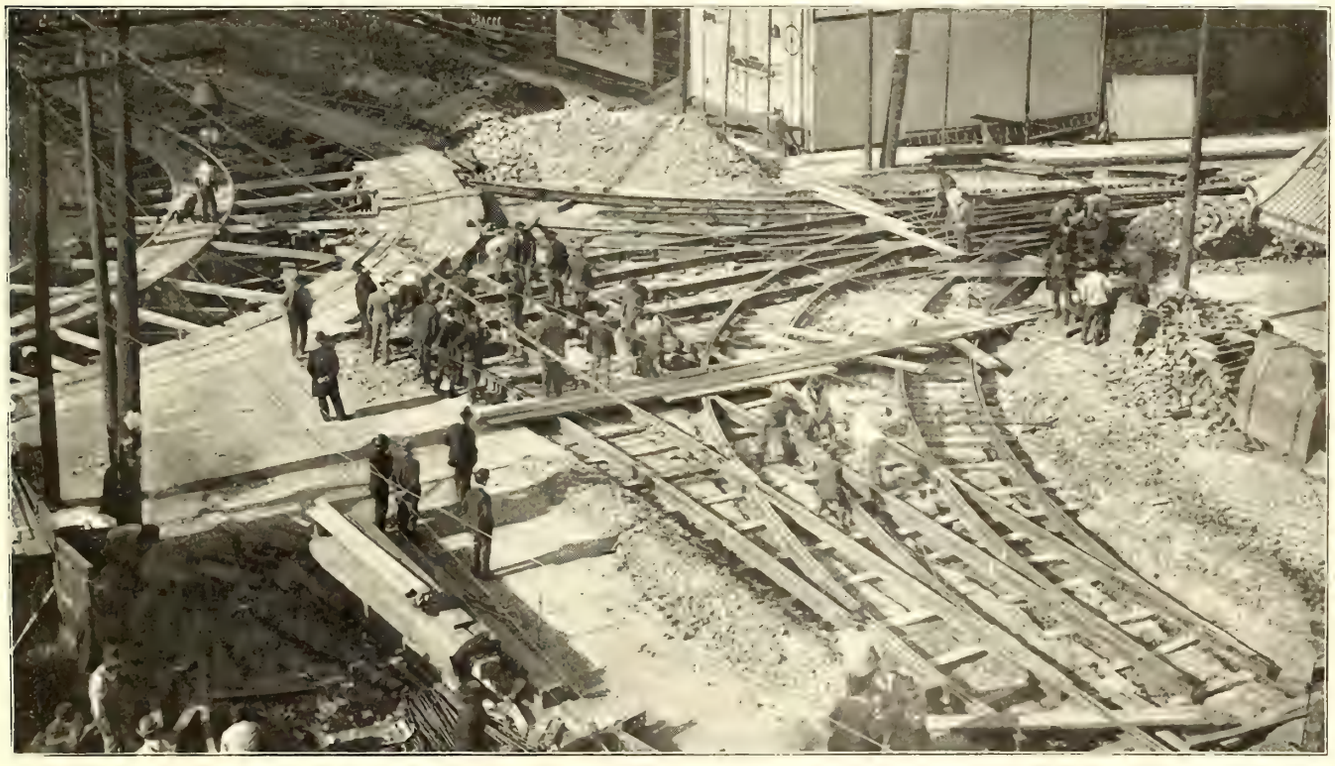
In re-equipping some of the cable lines for electric cars the tie-rods holding the slot rails from closing have been cut, thus allowing the pavement to force the slot rails together and close the slot. It was found, however, that the slot rails do not always come together at the same level, one slipping under the other in some places, giving a bad surface. In the re-equipment of other lines the slots have been closed by filling the whole conduit with rock dust; this gradually settles and must be re-filled several times, after which it leaves a firm foundation for paving in case at any time the slot rails are removed and the tracks repaved.

THE CARS AND CAR LICENSES

The company owns about 800 cars, about half cable and half electric of various types, shown in the group of differ-

ent scenes herewith. These cars were made by the Stephenson Company, Laclede Car Company, St. Louis Car Company, American Car Company and Brownell Car Company, are mounted on Peckham, Brill and Dupont trucks, and are equipped throughout with General Electric motors. For the Westport line, which has an extremely long, heavy grade, the company recently ordered double-truck cars, each equipped with four G. E. 57 motors and with the Christensen air brake system, with independent motor-driven air pump. To avoid accidents the running-boards have been taken off from the sides of open cars as far as possible, and an aisle has been cut through the center to give access to and from the platforms at a sacrifice of considerable seating space. The electric cars, almost all of which are closed, are provided with gates operated from the opposite platform, so that no one can enter or leave the car until the motorman opens the gate on the rear platform, or after he closes it. While this causes some loss of time the reduction of the accident account is a great advantage.

CONSTRUCTION WORK AT KANSAS CITY



LAYING A COMPLICATED DOUBLE-TRACK CURVE

For each of these cars the company is obliged to pay a license fee of $30 per year in Kansas City, Kan., as well as in Kansas City, Mo. Cars operating in both are obliged to

have separate licenses for both, even in the case of those that simply cross the State line for a block or two at the end of their route. The road is obliged to put up in each car a separate license. Some 600 of these are taken out at the beginning of the year, and paid for at the rate of $20 apiece. At the end of the year the average daily run, on an eighteen-hour basis, is figured up and the cities are paid a sufficient amount over and above that paid for the original licenses to cover the average number of cars run at $30 per year. The total car hours per year on the system figure up equivalent to about 300 cars, eighteen hours, 365 days.

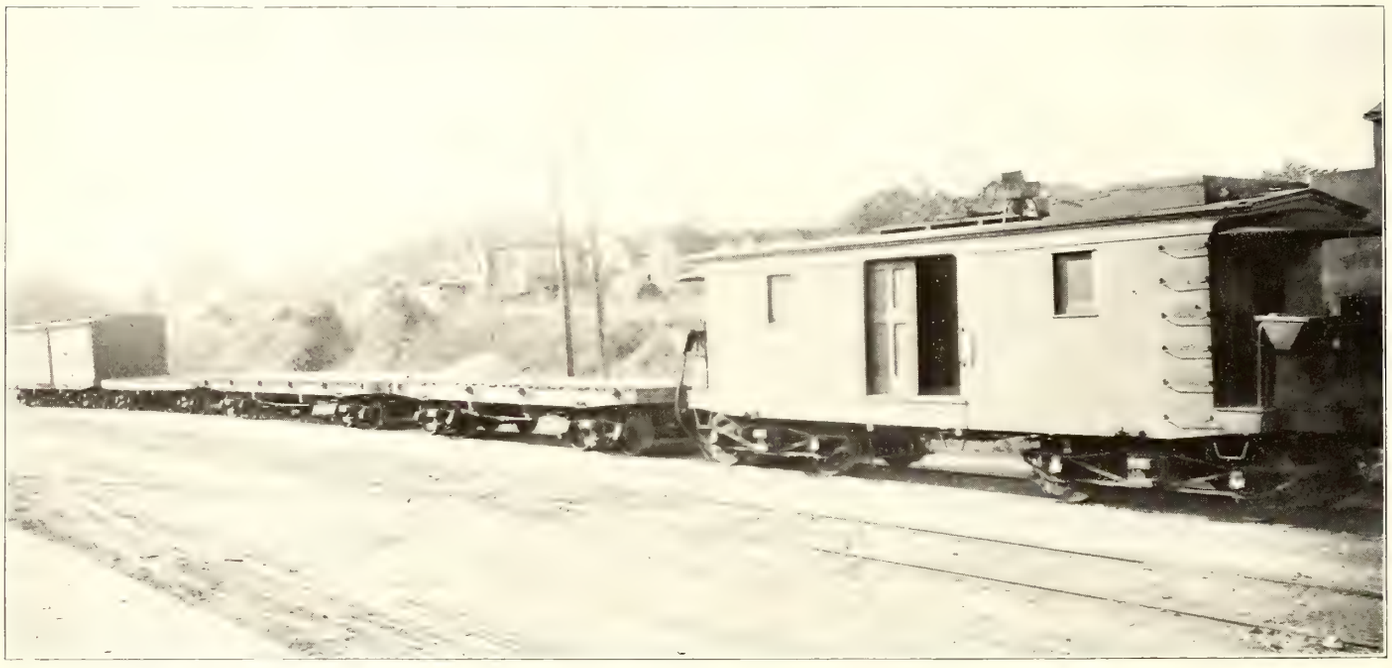
OVERHEAD CONSTRUCTION

The methods used by the electrical department of the Metropolitan Street Railway for furnishing specifications for overhead lines and for keeping track of work already put in have some features differing from the practice of other roads, and will be of interest. This work is under the charge of Charles Grover, who is chief electrician of the Metropolitan Street Railway Company. Before any new construction work is done specifications are prepared for the entire route with drawings, showing the location and spacing of all poles, guys, section insulators, etc. If bids are asked on the work these plans form part of the specifications, and at any event they are the plans which the linemen follow for the work. All poles are 6 ins., 7 ins., 8 ins., and 31 ft. long, unless specified otherwise by a letter, which letter corresponds to some other kind of pole, as given in the side notes. The distance between each pole is given directly on the plan of the route. Blue prints of this kind for each section of the line are issued. One feature recently adopted is the drawing of a double circle for all poles not of the above dimensions, so that in glancing over the plans special poles are more easily distinguished. The feeders are indicated by a heavily dotted line on one side of the street and the distances on the other side. The explanations of all abbreviations used are to be found on one side of each blue print.

The insulated bolts used on this road are the same for both the trolley hangers and strain insulators, and are all interchangeable, so that only one kind is kept in stock. The copper data for the system, that is the location, length and size of conducting lines, both trolley and feed, are kept on another set of blue prints. These are in no sense maps, no attention being paid either to scale or direction, but the lines are indicated with notations, which refer to points on a large city map with which the different points on the sheet can be located. This avoids the necessity of elaborate care in drawing, with the accompanying expense, while it secures equally as exact results as a drawing to scale.

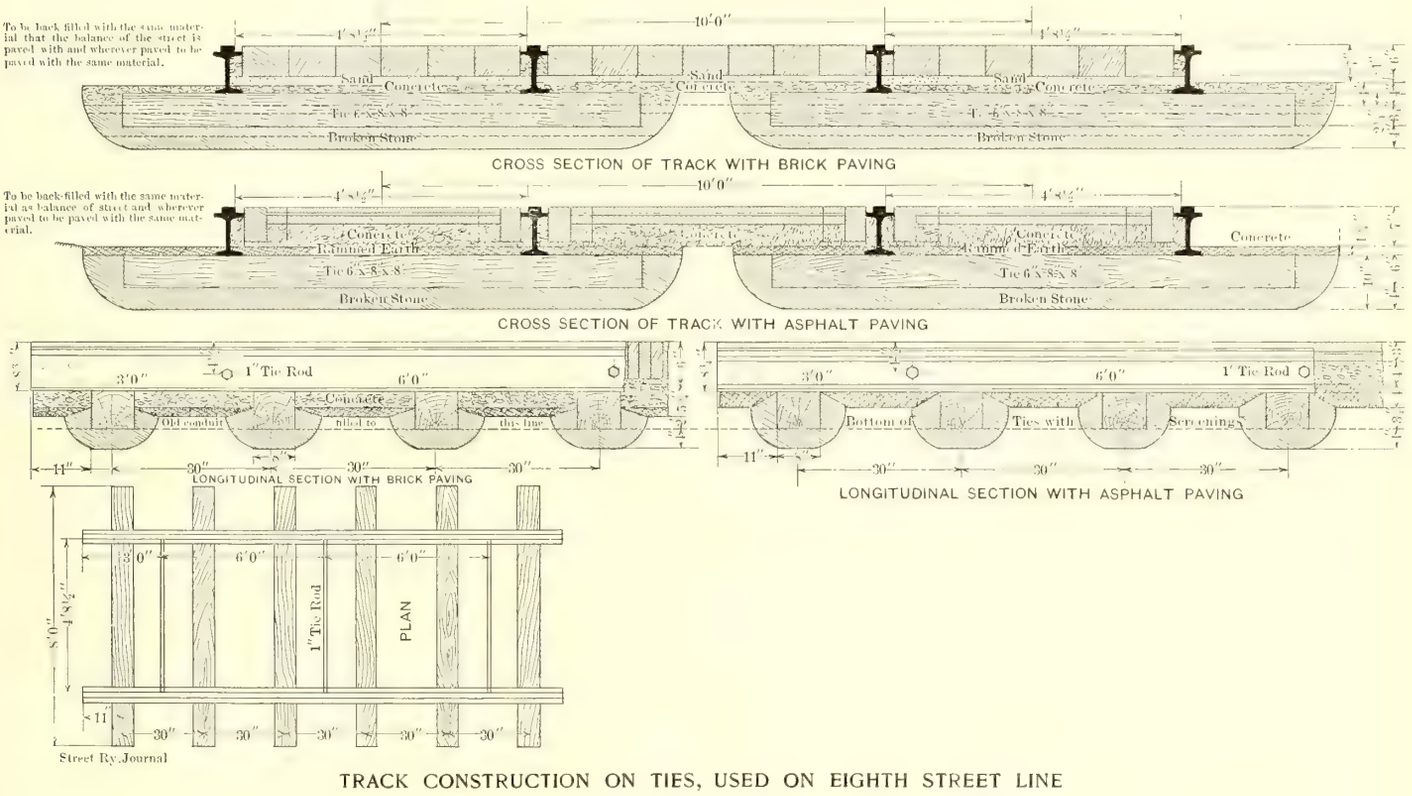
ELECTRIC LOCOMOTIVE

An electric locomotive is in use on the Independence line for hauling coal to the power station and for construction work. This locomotive was built in the Metropolitan shops, and has a number of features of interest, most prominent among which are the controllers, which are said to be the only ones in successful use to-day operating four motors in series, series-parallel or all in parallel without the use of any auxiliary commutating switch, and in the ordinary single revolution of the controller handle in acceleration. The four motors used are Edison No. 16, 30 hp. The controllers were designed by Charles Grover, the company's electrician, and were built in the shops. The motors are thrown four in series at first, then two in series, two in parallel and finally four in parallel. Four in parallel they run about 17 miles per hour. There are five series points, four series multiple points, and three multiple points. The controller is $44\frac{3}{8}$ ins. high, $22\frac{1}{2}$ ins. wide at the back, and $11\frac{1}{2}$ ins. deep. The cut-out switches throw the motors in multiple when one motor is cut out, and the controller is then only operated on five points when one motor is out. One of the strong points about the controller is the efficient magnetic blow-out. This is so strong in its action that it is not necessary to throw the controller entirely off before going from a higher point to a lower one, as there is little danger of starting an arc when passing from parallel to series. The blow-outs con-



ELECTRIC LOCOMOTIVE ON THE INDEPENDENCE LINE, DRAWING A TRAIN OF FREIGHT CARS

sist of small, flat coils, located in the vulcanized fibre guards between the rings. These coils are made of a few turns of flat copper strip, wound in a 1-in. iron core. The axis of each coil is parallel to the controller shaft. This controller by its series combinations permits the hauling of heavy loads slowly with very little current, and at the same time good speeds can be made if desired. The locomotive, which is shown in the accompanying engraving, is hitched to standard steam cars, and hauls them wherever they may be needed for fuel or ballast on the Independence line. It is not uncommon for it to haul three loaded coal cars. It weighs 20 tons, is 34 ft. long over platforms, has 40-in. platforms, and the wheel base of each truck is 7 ft. 4 ins. It is used as a tower car, and inside the car is a tower that can be raised with a windlass. The company has found it very convenient in its construction work.


CROSS SECTION OF TRACK WITH BRICK PAVING
CROSS SECTION OF TRACK WITH ASPHALT PAVING
LONGITUDINAL SECTION WITH BRICK PAVING
LONGITUDINAL SECTION WITH ASPHALT PAVING
PLAN
Street Ry. Journal

TRACK CONSTRUCTION ON TIES, USED ON EIGHTH STREET LINE

THE POWER HOUSES

For running the various cable lines there are several cable-driving stations scattered throughout the city. Some of these contain small electric generators, but practically all of the power for the electric lines is generated in the Kaw River power station in Kansas City, Kan. This station contains engines with an aggregate rated capacity of nearly 7000 hp, and is fitted with all the latest improvements, making it one of the most economical stations in the country, power being turned out at a cost of less than one-half cent per kw-hour. The building is a brick structure, with steel framework. The engine room is 144 ft. long and 63 ft. wide; the boiler room is 144 ft. long by 51 ft. wide, and the height of both is 33 ft. 7 ins. from the top of the foundations to the underside of the bottom chords of the roof trusses.

The boiler room contains both Babcock & Wilcox boilers, and Cahall boilers of the horizontal type, in batteries of 500 hp each. To these, four 500-hp boilers are soon to be added to bring the boiler capacity up to the power requirements of the engines. The boilers are fitted with B. & W and Green chain-grate stokers, which work very satisfactorily on the Cherokee slack, which is the fuel used in that part of the country, this fuel being mined a short distance south of Kansas City in Kansas. The steel stack of this station is 175 ft. high above the brick work. Coal is handled by means of a Hunt conveyor and cars into bins over the boiler room, with a capacity of 600 tons, from which bins it descends through chutes to the stokers.

The engine room, a view of which appears on the first page, contains four Allis-Corliss horizontal engines of various sizes and cylinder arrangements, some being tandem and some cross-compound. Two of these are direct-coupled to Walker generators, and two others to General Electric machines. The last of these four units was put in during the present year, and deserves more than passing notice, as it is one of the largest railway machines in the country. The engine is rated at 2500 hp, the generator being rated at 1600 kw, with a 40 per cent overload capacity for three hours' time. This engine has independent Allis air and circulating pumps, in this particular case the two machines being independent of each other. The engine exhausts into a Wheeler condenser with an effective surface of 5000 sq. ft. The shaft of this engine is of the hollow-forged fluid-compressed steel type; the fly wheeel is 24 ft. in diameter, with a weight of 160,000 lbs.

The switchboard of this station is double-decked, the feeder panels being put on the gallery. It is notable for the number of recording wattmeters in use, designed to give records of the amount of power used on the different lines, the lines being as a rule separately run on individual feeders, overhead copper not being cross-connected out on the lines. As this station supplies all of the electric lines with the exception of the Independence road, and as it is some distance from several of the roads on the Missouri side, a large amount of copper runs out from it, there being thirty feeders with a cross-section varying from 300,000 to 1,000,000 circ. mils.

This station during the year 1899 turned out 5,608,000

kw-hours, burning 13,616 tons of coal, or 4.86 lbs. of coal per kw-hour. The coal burned usually is Cherokee slack.

The only electric power station outside of the Kaw River station is a comparatively small one on the Blue River at a point where the line to Fairmount Park and Independence crosses, this station running the Fairmount Park & Independence line only. This station contains a 250-kw and a 400-kw General Electric generator, direct-driven by simple, condensing Corliss engines. The boilers are of the horizontal tubular type, and manual stoking is used.

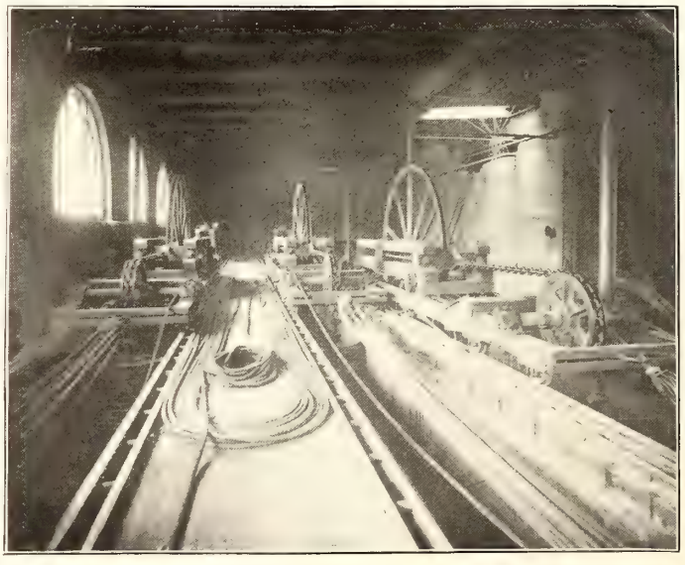
An interesting detail of the power stations is the motor-driven cable station, in which a 300-kw T. H. four-pole generator is used as a motor to drive 24,000 ft. of cable. About ten to sixteen trains are on this cable at one time, the line having one 10 per cent grade. The motor input varies from 200 amps. to 600 amps., running up to 800 amps. on heavy days. The motor is compound-wound, half of the original series coils being used for this purpose, the two coils on two opposite poles being cut in, the two other coils being cut out. The motor is started with a water rheostat. Complete duplicate motors, cable drivers and cables are provided on this line.

STANDARD DOUBLE-TRUCK CLOSED CAR

STANDARD SINGLE-TRUCK CAR

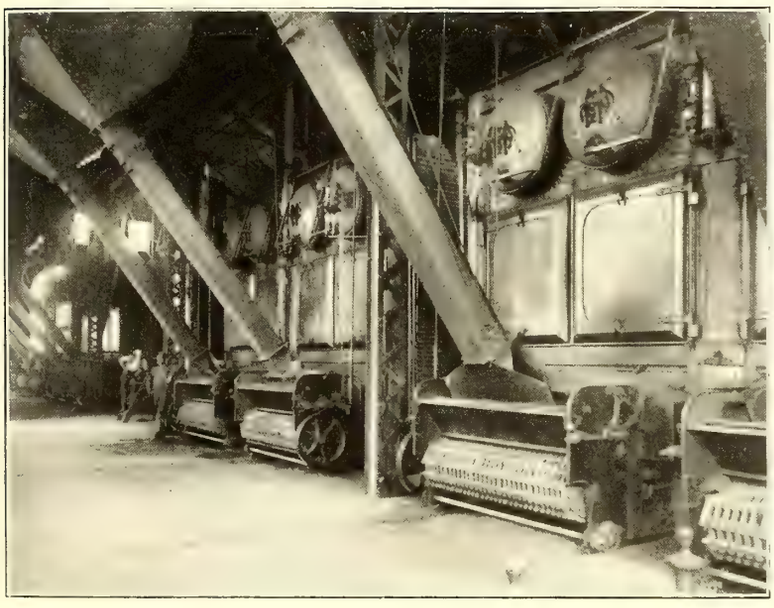
STANDARD DOUBLE-TRUCK OPEN CAR

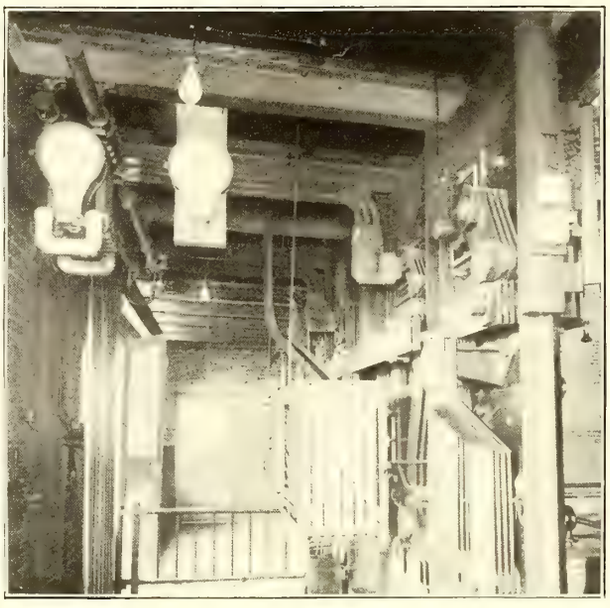
The cost of the cable system is considerable for renewals. The Ninth Street rope is 21,000 ft. long, and has to be renewed about every forty days, the ropes taken out from this line being used on more level and less heavily traveled routes, on which the cables will easily last from six to nine months. Before any of the cable lines were changed over to electric there were about 350,000 ft. of cable in use, which cost from $75,000 to $90,000 per year for ropes alone. The cables run at a speed of about 12 miles per hour, on some of the residential lines. The cable cars make a schedule of about 9 miles per hour, and the electric cars about 12 miles.



CABLE STATION AND TENSION RUNS, FIFTEENTH STREET AND GRAND AVENUE

The cable road, whose power is now derived from an electric motor taking current from the main electric power station, is the Summit Street line. This line has a length of a little over 4 miles, measured as single track, and was formerly operated by a 24-in. x 48-in. Wright automatic cut-off engine. The power from the motor is transmitted to the original cable machinery by a belt 36 ins. wide, passing over a 34-in. pulley on the motor to a 24-ft. pulley on the cable machinery. The management of the company reports that the cable machinery has been operated more successfully and satisfactorily by the motor than it was by the engine, and with greatly reduced cost.





VIEWS OF THE KAW RIVER POWER STATION

The rates paid gripmen, motormen and conductors in Kansas City are as follows: The men on the cable lines are paid 17 cents per hour during the first year, 18 cents during the second year, 19 cents during the third, fourth and fifth years, and 20 cents after that period of service. On the more important electric lines the men are paid just one cent less for the several different periods; on the smaller and less traveled electric lines 2 cents less.

COST OF STATION OPERATION

Owing to the operation by the company of two stations with dissimilar equipment the opportunities for studying the economical production of electric railway power, under different conditions, are unusually good in Kansas City. The Kaw River, or Central Avenue station, has a national reputation as being one of the most economical in cost of power production of any in the country. The figures from this plant for the first seven months of 1900 show that the average total cost of power, exclusive of interest, taxes and insurance, was $.0041 per kw-hour for this period. The cost of coal runs about $1.20 per ton. The load was usually carried by two 1200-kw units, with a 550 kw to take the owl car load. At the present writing eleven men run the plant twenty-four hours.

The figures from the Blue River station show that the average total cost of power, exclusive of interest, taxes and insurance, for the first seven months of 1900 was $.0079 per kw-hour. This is not quite double that of the Central Avenue station. At first thought this might be credited

entirely to the labor-saving appliances in the Central Avenue station boiler room, but the difference is not entirely there; in fact the difference in fuel consumption per kw-hour in the two plants is almost as great in proportion as the difference in total power cost per kw-hour. The differences in the equipment of the two stations, which are accountable for the differences in cost of power, are as follows: Large as against small direct-connected units, compound-condensing as against simple condensing engines, water-tube as against tubular horizontal boilers, and mechanical as against manual stoking. The comparison is especially valuable because both stations are owned by the same company, and operated in the same manner. It is also of much interest as throwing light on a problem many electric railway engineers have to face these days, namely, whether the economies of a large station and large units, as compared to a number of smaller stations with smaller units, is sufficient to warrant putting in a polyphase high-tension distribution system. The Blue River plant is a well equipped and modern plant, as stations of that size run. The conclusion that must be reached after comparing the efficiencies of the two plants in dollars and cents is that there is considerably more difference between the economy of well equipped large and small stations than has heretofore been generally thought. The object lesson in economical power generation furnished by the Central Avenue plant has been made good use of in Kansas City, as the Kansas City Electric Light Company, which is controlled by prominent stockholders in the Metropolitan Street Railway Company, will probably soon build a large central generating plant on some good river location, and distribute by polyphase high-tension currents to sub-stations. A similar plan has been talked of from time to time for the street railway, and it is not unlikely that it will ultimately be carried out for distribution to lines not economically supplied by the Central Avenue direct-current station. Charles Grover, chief electrician of the Metropolitan Street Railway, has given the matter of polyphase distribution considerable attention, and calculates that the Central Avenue station is now supplying a larger area than economy would justify if a polyphase distribution were in effect. He believes that the present limit of economical feeding direct from the power house is located on the east at about Grand Avenue, and that all east of that point could more profitably be fed in some other way. The present electric plants in cable power houses are, of course, not very economical, and what little they furnish to supply the trolley lines could better be furnished by sub-stations located in the same buildings. The ultimate solution of the power distribution problem in Kansas City will be watched with interest.

The polyphase generating plant, when built, will be erected on the Blue River immediately adjacent to the site of the present power house at that point. It will contain several 25-cycle 6600-volt generators of 1500-kw or 2000-kw sizes; the details of this equipment not having been determined by the consulting engineers, Messrs. Pierce, Richardson & Neiler, at the time of writing this article. Two rotary-converter sub-stations for the traction system will be put in at the present cable stations of the railway company, one at Eighteenth and Olive Streets, and the other at Eighth and Woodland. These stations will lift off a large part of the Missouri load from the Kaw River station, cutting down greatly the amount of copper required for feeders, and, as described, will leave the Kaw River station to supply only loads on its own side of the city.

CAPITALIZATION

The authorized capital stock of the Metropolitan Street Railway Company is $8,500,000, of which $5,586,000 is outstanding. The company has issued $5,100,000 in 5 per cent bonds, and has guaranteed about $7,500,000 of bonds of underlying companies. The gross earnings for the past four years are as follows: 1896-97, $1,774,892; 1897-98, $1,949,605; 1898-99, $2,094,378; 1899-1900, $2,353,267.

The dividends have been 2 and 2½ per cent annually until 1899, when 1 per cent quarterly was paid. This has been increased during the present year to 1¼ per cent quarterly, or 5 per cent annually. It is now proposed to reorganize the financial affairs of the company in such a way as to provide for the proposed changes mentioned above, and without detriment to the present stockholders.

The heaviest owner of the Metropolitan Street Railway Company is P. D. Armour. The officers are: P. A. Valentine, chairman of the board of directors; W. H. Holmes, president; L. E. James, vice-president; C. F. Holmes, general manager; D. B. Holmes and Frank Hagerman, general counsel; W. A. Satterlee, general superintendent; D. W. Dozier, chief mechanical engineer; E. W. Butts, civil engineer; Charles Grover, electrical engineer; J. A. Harder, auditor, and J. W. G. Becker, master mechanic.

The directors of the company are: C. F. Morse, Wallace Pratt, C. F. Adams, P. A. Valentine, W. H. Holmes, L. E. James, Norman B. Ream and C. F. Holmes.

W. H. HOLMES

C. F. HOLMES

W. A. SATTERLEE

THE EAST SIDE ELECTRIC RAILWAY AND ITS PARK

The only street railway line entirely in Kansas City and independent of the Metropolitan system, is that of the East Side Electric Railway Company, popularly known as the Heim line. The road was built by three brothers, familiarly known in Kansas City as Joe, Ferd and Mike Heim, the owners of a large brewery, to reach which was the primary object of building the line. The Heim brothers wished the Metropolitan company to build the line, but as the latter did not consider it a profitable extension, the brothers built it themselves. The line is 3 miles long, double track, and runs from the Market Square in a direction generally eastward along the low lands near the Missouri River. Extensions are now definitely planned which will make the line 7 miles in length, and further extensions are being considered for the future. The company has issued no bonds, and no stock to anyone outside of the owners mentioned above. The line is operated under a franchise running until 1925, calling for free transfers to the Metropolitan system, and requiring the same car license that is paid by that system, viz., $30 per car per year.

The construction of the line was commenced on June 22, 1899, and the cars were first run on Nov. 27. The track consists of Johnson 82-lb. rails, laid on ties 27 ins. between centers, bedded in concrete, which fills the space between and over the ties and over the foot of the rail. The joints were cast-welded by the Falk Company. The line owns fourteen cars, of which about ten are in use regularly. Six of these are very handsome, and are 40 ft. in length, with cross seats and smoking compartments. They were built by the St. Louis Car Company, and are driven by Westinghouse No. 49 motors, two per car. The remainder of the rolling stock is made up of single-truck open cars, designed for the heavy traffic to the park.

The power house of this line contains one unusually handsome and smooth working unit, consisting of a Siemens & Halske 200-kw generator, direct-coupled to a St. Louis-Corliss engine, running at 100 r. p. m. In addition there are two D 62s and two 110-volt lighting machines for illuminating the park. The 500-volt switchboard of the power house consists of an old T.-H. board, which has been remodeled, with back connections and instrument cases.

The park of this line, covering about twelve acres, is Kansas City's greatest summer-night attraction and vaudeville-entertainment resort. The theater, 140 ft. x 110 ft., with latticed walls, through which the breezes can blow, has a seating capacity for 3000 people, and a stage completely equipped with all desirable appliances for the vaudeville entertainments which are given with frequent change of bill, the theater being what is known in that part of the country as an Orpheum Circuit. Undoubtedly the greatest attraction of the park is the electrical spectacular fountain, built by C. A. Dunlap, of Providence, R. I., and equipped with the unique features of Dunlap fountains. These features are tableaus, dances, living pictures, etc., surrounded by a wall of jets of water. The characters taking part in the dances or other scenes are brought up from the base of the

VIEWS IN HEIM PARK

A GENERAL VIEW OF THE PARK

fountain to the field of view by means of an elevator with a glass platform, through which they may be illuminated by projectors from below. The jets forming the wall of spray about this little stage are all inclined outward, so that no water need strike the dancers. With the many possible changes of the figures produced by the jets and of the colors thrown into the water from below, as well as from projectors located in an operating cabin outside of the little pond around the fountain, the spectacle is an unusually beautiful one. The evening's display of this fountain is ended by sending up a fireworks frame on the elevator, the exploding fireworks being surrounded by a wall of illuminated spray. The park has the other usual features of resorts of this class, including a cinematograph, a band stand, bowling alleys, a billiard hall, etc. The whole is brilliantly lighted by current from the neighboring power plant of the line, 500 volts being used for the outdoor lighting and 110 volts for the theater lighting. A large number of Adams-Bagnall enclosed arc lamps are used, supplemented with incandescent lamps to trace out the architectural features of the buildings, and to illuminate some handsome shade trees, making them resemble by night enormous Christmas trees. An admission of 10 cents is charged to the park, seats in the theater costing 10, 20 and 30 cents extra.

The president of the East Side Electric Railway Company is J. J. Heim. The management and operation of the road are entirely in the hands of W. O. Hands, who constitutes the entire staff of active officers of this small line.

INTERIOR OF CLOSED CAR

CAR HOUSE

THE KANSAS CITY-LEAVENWORTH LINE

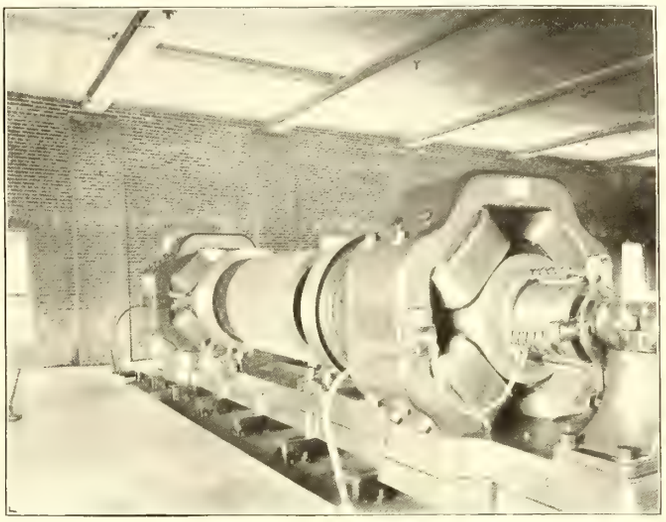
The only interurban line running out of Kansas City is that of the Kansas City-Leavenworth Electric Railway Company, which runs in a direction generally northward and parallel with the Missouri River to the city of Leavenworth, Kan. This place, which has a population of 25,000 inhabitants, is 26 miles from Kansas City. The district through which the road runs is a highly cultivated farming country with no intermediate towns of importance with the exception of one named Wolcott, in honor of some of the gentlemen associated with the road, at which place are located the power station, car houses, shops, offices, etc., of the line. The road has been in operation but a short time; its construction was commenced in April, 1899, and regular service was started in January of this year. The line is single track, runs almost entirely on its own right of way, and its rails and special work are of standard steam railroad form, so that the wide tread and deep flange of steam railroad wheels can be used, making possible unusually high-speed service.

The road at present starts from Grand View, a point in

EXTERIOR OF KANSAS CITY & LEAVENWORTH STATION AT WOLCOTT

Kansas City, Kan., about 3 miles from the business center, reached by one of the branches from the elevated line of the Metropolitan Street Railway Company, but the interurban line has obtained a franchise to run down further into Kansas City, Kan., nearer the center of the city. In Leavenworth the road is associated with the local street railway company, and runs over its lines to the center of the city. The road winds in and out among the hills with many curves, but is, as a rule, fairly level, although there are some 4 or 5 per cent grades. The track construction consists of Johnson 61-lb. T-rails, on selected white oak ties, laid 2 ft. between centers on rock ballast 12 ins. deep. The company has its own motor-driven rock crusher, shown in one cut, for preparing its ballast. Spring switches and frogs are used in the turnouts, so that the cars can run through them at high speed. The rails are fastened together with American rail-joints, covering Atkinson protected bonds. Two 000 Fig. 8 trolley wires are used, suspended from brackets.

Practically the whole line is supplied with power from one generating station at Wolcott, Kan., about 12 miles from either end. At Leavenworth the line is electrically connected with the power house of the Leavenworth system, but the Wolcott station, 12 miles away, feeds the Leavenworth lines more than the Leavenworth power house feeds the interurban line. On account of the long distances over which current is distributed a large cross



INTERIOR OF KANSAS CITY & LEAVENWORTH RAILWAY POWER STATION

section of feeders is necessary. These are of bare aluminum, with a cross section of 362,000 circ. mils. Nine of these feeders run out from the power house for various distances along the line, six in one direction and three in the other.

Through service from Kansas City to Leavenworth is given every hour on week days and every half hour on Sundays, the schedule time of covering the 25 miles between the two cities, with about fifteen regular stops, being one hour and fifteen minutes; this requires three cars on week days and six to eight on Sundays. The rates charged are 50 cents between the two cities in one direc-

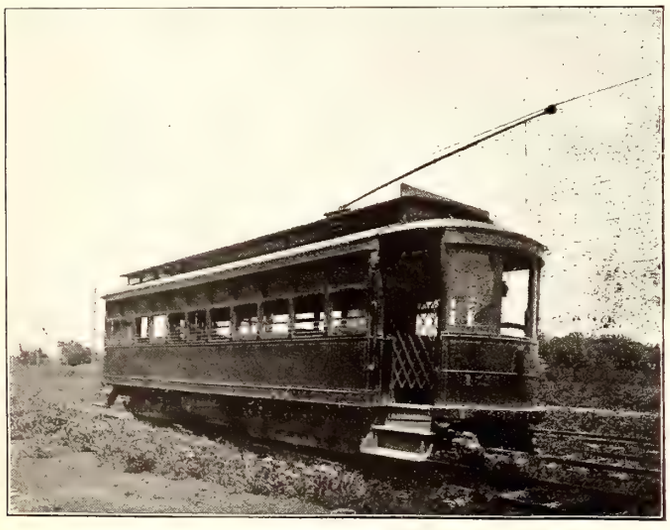
KANSAS CITY & LEAVENWORTH SHOPS

tion, and 75 cents for the round trip, with local fares in proportion. A lower rate is made to inmates of the Soldiers' Home, near which the line passes, as well as to clergymen, sisters of charity and members of the Salvation Army. A newsboy distributes ice water and sells fruit and other commodities in the cars after the fashion common on steam

railroad trains. There is considerable competition with the steam railroads, of which four run between Kansas City and Leavenworth, the Missouri Pacific Railway being the most active competitor, with seven trains each way per day, making the run in about fifty minutes, and charging $1 per round trip.

ELECTRIC LOCOMOTIVE AND CONSTRUCTION TRAIN

The ten cars constituting the rolling stock of this line—made by the American Car Company—are of the style shown below. They are 41 ft. long, with an unusually wide body, about 9 ft. over all, giving ample room for cross seats. All have smoking compartments, and some of them have baggage rooms. The weight is 22 tons each. They are driven by Steel 50-hp motors, four per car, geared up to a speed of 45 miles per hour. The motors are controlled by one Steel No. 44 controller per car, the cars being single-ended, and running around a Y at each end of the route. The cars are equipped with the Magann storage air-brake system, which is remarkably successful, considering the length of the run and the consequent



INTERURBAN CAR

length of time between re-charges. The air is compressed in the power station at the middle of the line by an Ingersoll-Sergeant air compressor to a pressure of 300 lbs. per square inch, and the storage tanks on each car have sufficient volume to carry the car two complete round trips, aggregating 100 miles. The air passes through a reducing valve before reaching the brake cylinders, so that it is impossible to apply full storage-tank pressure to the cylinders. This valve is set to give 45 lbs. per square inch.

The company also operates an electric locomotive with the same equipment of four 50-hp motors, geared down to 20 miles per hour. This locomotive hauls coal and ballast, and handles the work train. On holidays the road gets a rush of pleasure traffic, owing to the agreeable nature of the ride upon it over the picturesque rolling and farming country through which it runs. This heavy traffic is handled by means of some cattle cars which the company has converted to passenger uses, these cars being drawn by the electric locomotive. A park is to be built on several hundred acres of land owned by the company at Wolcott to accommodate and attract more of this excursion traffic. The company also owns a steam locomotive, which was used for construction work, and which appears in the accompanying illustration.

The power station at Wolcott is the substantial-appearing brick building shown herewith. A noticeable feature of the exterior of the station is the stocky chimney, which

STONE QUARRY AND CRUSHER

is unusually large in girth and heavily tapered for its height of 140 ft., so as to resist the high winds and cyclones common in this part of the country. The station contains four Stirling boilers, one Hamilton-Corliss single-cylinder engine, belted to two 300-kw General Electric four-polars set up in line with each other, and connected by clutch couplings to the central pulley. This equipment will necessarily be increased as the traffic grows, and on account of the length of the lines polyphase apparatus will probably be put in. The power station is of sufficient size to accommodate large extensions.

The line was built by the Cleveland Contracting Company, of Cleveland, Ohio, which company is interested in several interurban electric railway properties in different parts of the country, among them the Tiffin-Fostoria line, the Hamilton-Cincinnati line, and others. The officers of the Kansas City-Leavenworth Railway Company are: President, D. H. Kimberley; vice-president, W. H. Gabriel; secretary, C. O. Evarts, all of the Produce Exchange Bank, of Cleveland, Ohio. The general manager of the road is H. W. Wolcott, of Wolcott, Kan.

ELECTRIC RAILWAY PRACTICE IN FRANCE

BY A. N. CONNETT

The transformation from animal to mechanical traction of the street railways in France is an accomplished fact, or at least will be when the work now in progress is finished. The exceptions to this broad statement are the cities of Toulouse and of Paris. In the former city the reason is entirely local, and will probably soon disappear. In Paris much has to be done, and very important transformations are on the eve of being terminated. But even then much will remain to be done in Paris to give a first-class service. This transformation has been mostly electric. Other methods such as stored steam, compressed air, the Serpollet boiler, and even one feeble little single track cable road are in use, and these systems have their advocates. But here, as elsewhere, it is the trolley wire which has made this general transformation possible.

Municipal ownership and operation of tramways is as yet unknown in France. This may come in some form or other when existing franchises expire, and the properties revert to the State or the municipalities, as the case may be, this being a universal franchise condition. But it is more than probable that other arrangements will be made in the majority of cases. At least the tendency in France, at this moment, for concessions about to expire seems to be to prolong them, the companies making important concessions in the way of lowering their tariff and extensions during the period yet to elapse under their original agreement.

The taxes are not overburdensome. They appear in many different forms, payable both to the State and the municipality. For example, the municipal taxes paid by the Omnibus Company of Paris—the most important tramway company in France—are under eight different heads, and aggregate 7.6 per cent of the gross receipts—the State taxes under six heads aggregating 2.7 per cent of the gross receipts—the total being 10.3 per cent. Tramway companies in the provinces are not so heavily taxed—due to the fact that taxation is heavier in Paris than elsewhere. The length of franchises varies between one hundred years and thirty years, and there is no fixed law or rule regulating them. In general the practice is this: If the concession is one involving a heavy expenditure and probable light receipts a long time is given before expiration, so that the investment may be liquidated in a way not to be so onerous to the investors that the enterprise would be financially impossible.

Track construction differs very much in the substructure. Many lines have been and still are constructed by laying the rails directly on the earth with no prepared foundations. The rails are simply held to gage by tie-rods. The motion of the cars with any speed is bad from such an uneven track, and the joint problem, unsatisfactory enough at the best, is aggravated. This primitive method of construction is disappearing, as the results of experience are beginning to be more and more evident. The track foundation when now made is usually concrete. When the requirements of paving demand a concrete base the rails are laid upon it. When wooden permanent way is used, the concrete usually extends above the base of the rail, so that it is solidly embedded in the concrete. The disadvantages of this are evident, but it has one thing in its favor, viz., that the rails are better able to resist the enormous pressure due to the swelling of the wood. In the case of tracks on the side of the road, or "sur accotement," as it is called, the type of track is T-rail, laid upon wooden ties with gravel ballast.

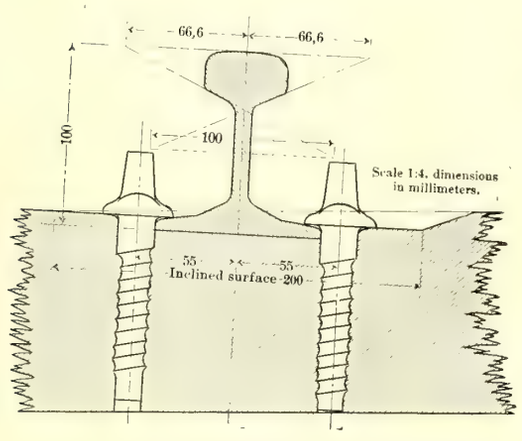


FIG. 1.—TYPICAL FRENCH T-RAIL SECTION

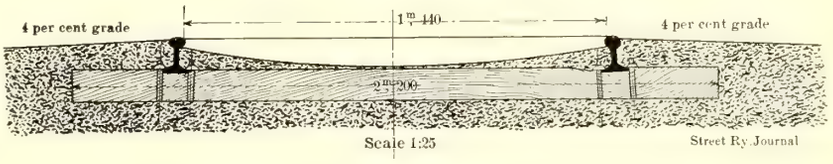


FIG. 2.—A TYPICAL CROSS SECTION OF T-RAIL TRACK

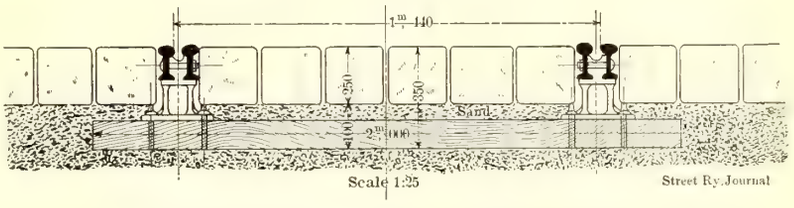


FIG. 4.—CROSS SECTION OF TRACK LAID WITH MARSILLON RAILS

The first type of rails used in France for horse cars was a rather peculiar form of the "strap"-rail. This is called the "American rail." Other types were introduced with mechanical and electrical traction. There are now three forms in general use.

1. T-rails, which differ but little from American sections. Spikes are usually replaced by lag screws, and the rails are laid slightly inclined inward. Fig. 1 shows a typical rail section with fastening to the tie, and Fig. 2 gives a good example of cross section of the track. There is quite an extensive mileage of track so laid for tramways in France, because the authorities prefer to put the tracks to one side of the road by themselves whenever the width of the roadway will permit.

2. Double or "Marsillon" rails as they are called. Fig. 3 shows views of this rail with its cast-iron chair and the

method of fastening. Fig. 4 shows a cross section of the track with ties, and paved with Belgian block. In Paris, where shallow wooden blocks are used, resting directly on a concrete foundation, the chairs are omitted—the filler block being simply used with a plate under the bases of the rails. The rails are anchored by special dogs to the concrete base to keep them in position. This construction has little to recommend it. It is evident that the metal used is badly distributed to give good results and a long life. It has the convenience of being able to separate the rails on a curve, so as to give without any special rail a wider groove, and also that the grooves do not pack hard with

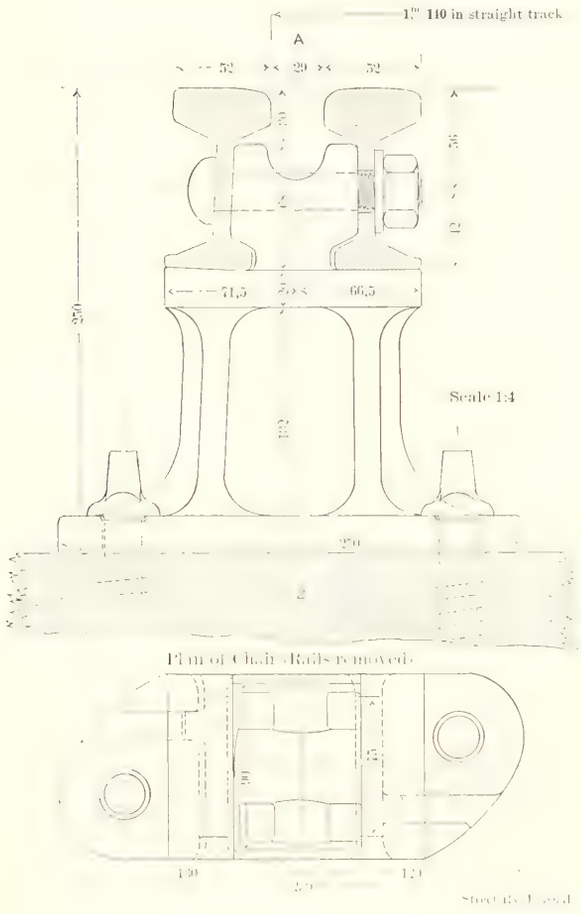


FIG. 3.—SECTION OF MARSILLON RAIL AND CHAIR

dirt, as with the ordinary grooved rail. Actual trials are said to have given lower traction coefficients with this rail. This form of rail is rapidly disappearing, and before many years it will probably be completely replaced by other types.

3. Girder rails are all of the full-grooved type, nothing else being permitted. Most of those in use are of French manufacture. Fig. 5 gives the sections of the principal types of girder rails rolled by the two mills in France which have taken up their manufacture. The first one shown is called the "T-H" section, and for this Fig. 6 shows the splice bars, and Fig. 7 the tie-rods. Fig. 8 shows the two rails tied together. It will be observed that this construction of tie-rod, while a very good one, requires that they should be made very accurately to the required length, so as to keep the track properly gaged. Fig. 9 shows the spacing of the tie-rods, and the manner of making the joints in practice. Rail specifications are very long, but on examining them carefully it is difficult to understand why they should be so voluminous. Great attention is given to cutting to length and to the drilling of the rails, and to the limiting variations which will be permitted from the specified dimensions. The carbon is seldom specified, but in its place is the resistance of the metal in tension. Some years ago the mills gave from 50 to 55 kilos. per square millimeter as the extreme limits, but these rails were much too soft, and they wear down in use very rapidly. But now under a little pressure the manufacturers are accepting 65 to 70 kilos., and even to 75 kilos. These rails are very satisfactory.

Fig. 10 is a cross section of the early track construction, with the rails laid directly on the earth or on a prepared

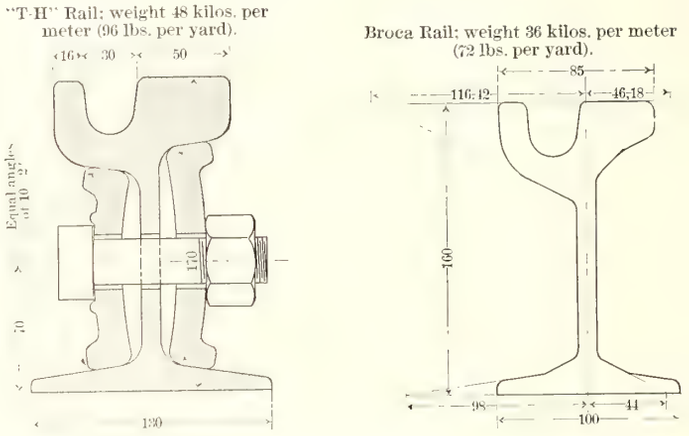


FIG. 5.—SECTIONS OF PRINCIPAL TYPES OF GIRDER RAILS ROLLED IN FRANCE

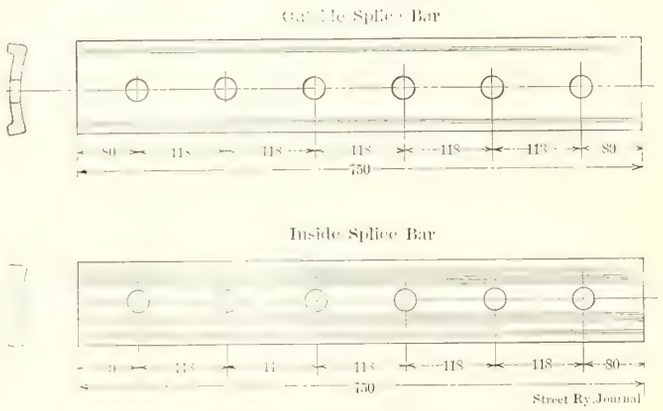


FIG. 6.—SPLICE BARS FOR T-H RAIL

bed of sand or gravel. As has been said before, this mode of track laying is rapidly disappearing. Concrete being cheap and wood dear, the former is used almost exclusively for rail foundations in paved streets. Fig. 11 shows cross sections of tracks adopted by one of the large tramway companies of Paris, one with wooden pavement and the other with Belgian block. Fig. 12 gives cross section of track adopted in one of the large cities. The bed of sand under the concrete stringers was a drawing requirement of the city engineer, but in actual construction it was naturally omitted.

The joint problem is forcing itself into attention now that the tracks of the earlier roads are going to pieces. The rail sections were very badly designed for good splicing, and the bars themselves were short, with four holes and small bolts. Naturally the conditions were the best possible for low joints, but attention is being given to this matter, and the later rail sections have been much improved, while the splice bars are usually the six-bolt type, with heavy bolts. Patented mechanical joints have not

been introduced as yet. The "cast-welded" joint has been quite largely used. Where it has been used on an old track with a weak rail, such as the light "Marsillon" rail, it has given poor results, the track being stiff at the joints and very flexible between. In consequence the motion of the cars was bad, and the noise due to the pounding at the stiff joint was even accentuated over what it had been before. But with heavy girder rails these joints have given so far good results, and they are favorably regarded, not only for new tracks but also to save old ones.

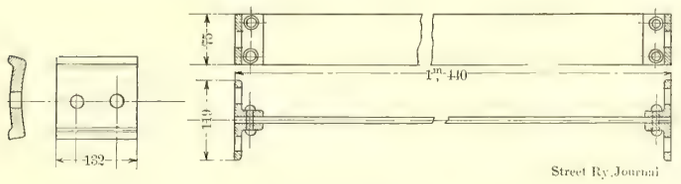


FIG. 7.—TIE RODS FOR T-H RAIL

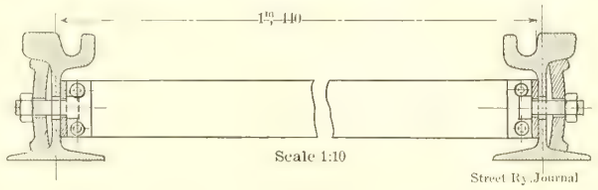


FIG. 8.—METHOD OF TYING

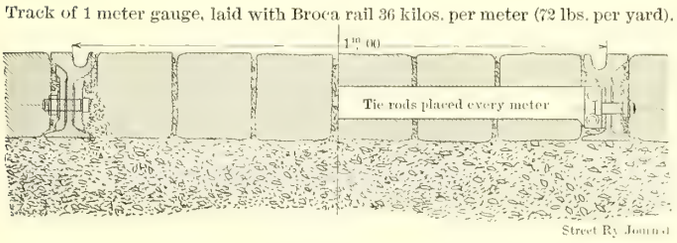

Track of 1 meter gauge, laid with Broca rail 36 kilos. per meter (72 lbs. per yard).
1m,00
Tie rods placed every meter
Street Ry. Journal

FIG. 10.—CROSS SECTION OF EARLY TRACK CONSTRUCTION

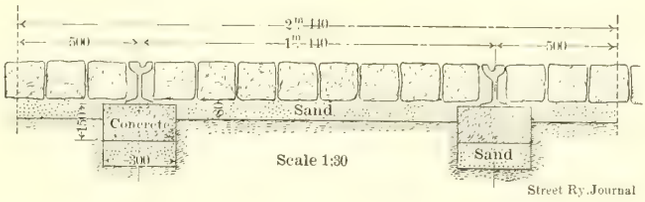


FIG. 12.—CROSS SECTION OF TRACK FOR CITY SERVICE

Special track work in general is of a primitive character. This is a natural consequence of the conditions here. In the United States, as it is well known, there are splendidly equipped shops, which are often separate departments of a large rolling mill and steel works, and these shops, managed by practical and trained engineers, make nothing but street railway special work. The need of something better than ordinary "built-up" work became evident, and by a natural process it was soon forthcoming. In France it is the engineer of the railway company who must take the initiative in designing the special work, with the fact before him that if he gets up something very different from the ordinary shop practice he will get nobody to undertake to make it except on such onerous terms as to make it impossible. Therefore there is no incentive to try to adopt good methods in special work, and the best one can do is to be content with "built-up" work. This is often made in the field—the rails being cut, drilled and spliced together with usually a good heavy sole plate riveted to the frog.

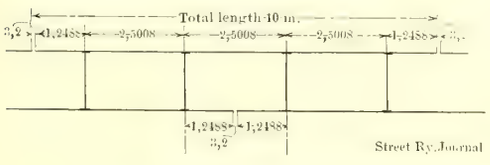


FIG. 9.—SPACING OF TIE RODS

The switches are made of rails assembled together; the tongue is straight on both of its sides. Fig. 13 shows one of the switches. Some cast-steel switches have been made here, and their use will become general probably in the near future. Curved rails are made on the ground with ordinary hand rail benders. The men are skilful at this work, and it is a cheap and efficacious way of making them. Rail bonds are generally of the standard American types, and there is nothing here novel about the bonds or methods of placing them. Track with cast-welded joints is not bonded at the joint, but the rails and tracks are frequently cross-bonded.

Overhead pole lines are much neater looking in France than in America. This comes from the fact that all work is treated from an æsthetic as well as from an utilitarian point of view, while in America the former is usually so subordinate to the latter that in actual results it is not visible. Trolley wire suspended in any way whatever in a public street cannot from the very nature of things be ornamental. The writer finds it difficult to say in just what the overhead wires differ in appearance from those put up in

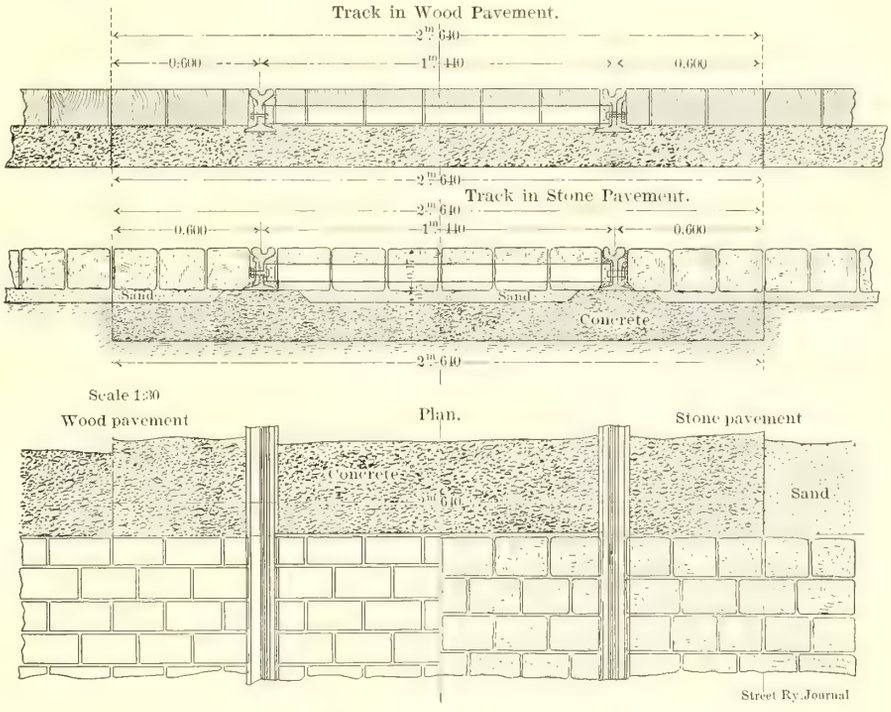


FIG. 11.—CROSS SECTIONS OF TRACK USED BY A PARIS TRAMWAY

America. The appliances are practically the same—line material which is made here being similar in material and

FIG. 14.—CENTER POLE CONSTRUCTION ON AVE. DUMESNIL, PARIS

form to American models. The difference in appearance must come then from the greater care taken in installing the lines not to shock the eye. But the greatest difference is in the poles. The bare poles themselves are the same in both cases, but they are decorated in French city practice so that they are in reality ornamental, and not an eyesore in the street perspective. Overhead feeders are nowhere permitted, and this one thing robs the overhead line of its most hideous feature, and makes the designing of an attractive pole a much simpler problem. The universal addition of ornamental cast-iron bases is also to be commended. These are often designed to be in harmony with the ornamental gas or electric light poles which may exist. Much interest is taken by the municipal authorities in this question, and sample poles have to be sometimes made (the ornamental bases being plaster models), and then put up in the street to see what the effect will be. The construction is often retarded in an annoying way, but in the end this extreme care is beneficial to all concerned. Where the street is wide enough, a center pole construction is usually adopted. About the pole a space is curbed and reserved for the use of pedestrians. These are called "refuges," a most appropriate name. They serve to direct vehicular traffic, and to make the crossing of a street a much easier operation than otherwise. The poles, with ornamental bases and handsome filagree brackets for the trolley wire supports, can also serve for electric or gas lamps. This construction is a most excellent one from every point of view, including the appearance of the street. It is difficult to understand why it is not more generally adopted on wide streets in America.

Fig. 14 shows a center-pole construction on the Avenue Dumesnil, in Paris, on the line of the Bastille-Charenton road. This is the only trolley line which has been permitted inside of the fortifications of Paris. The pole line is very fine in appearance. It shows what can be done to render poles unobjectionable in a public street. Fig. 15 gives the drawing of this pole, with the addition of two incandescent lamps, these being arranged for future application. Fig. 16 shows a center-pole construction in a provincial city. In this case the base is much less ornamental. The brackets are quite different, also due to the fact that this is a center trolley construction, while in the former case it is the side trolley. Fig. 17 shows a center trolley side bracket construction on the route between Nice and Villefranche. The overhead construction would be much more elegant, for this case, with the side trolley. Fig. 18 gives this latter case on the temporary line built just within the fortifications in Paris to carry people to the Exposition-Annex in the Bois de Vincennes.

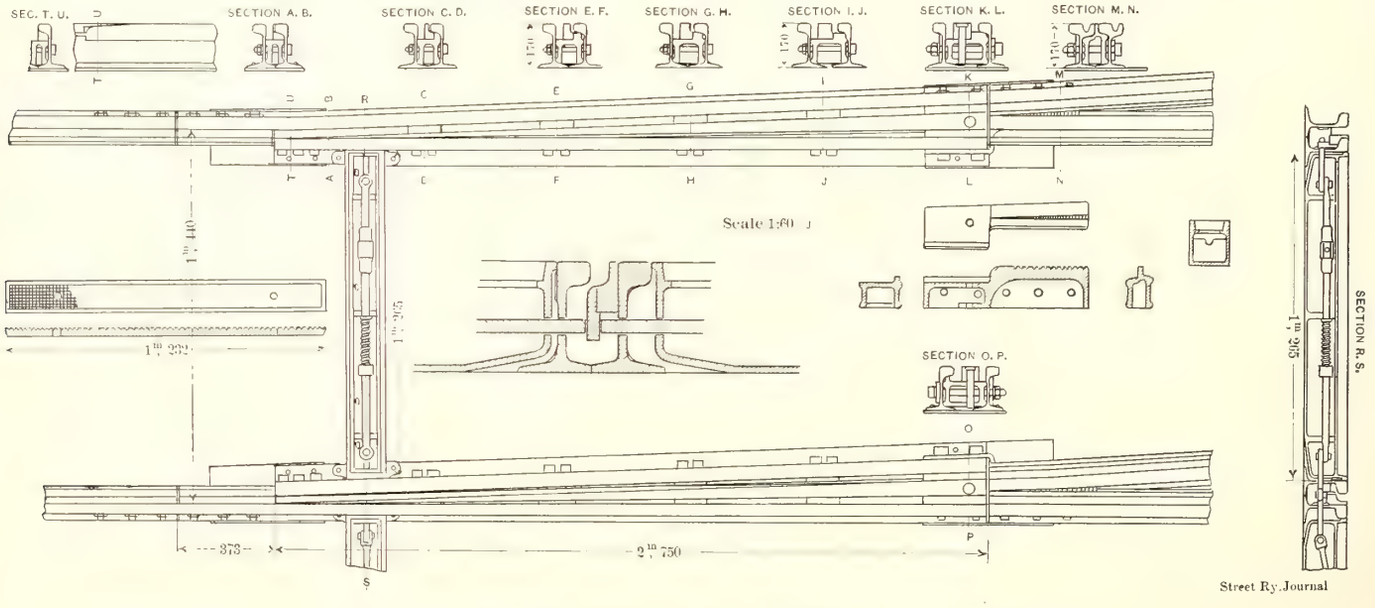


FIG. 13.—PLAN AND SECTIONS OF TYPICAL FRENCH TONGUE SWITCH

This side trolley construction is being very largely em-

ployed now—due principally to its being required by the administration for æsthetic reasons. It increases the difficulty of operation, the trolley wheel being much more liable to leave the wire than with the center trolley construction. As the trolley head must be swiveled it cannot take an overhead switch "running on the point" without having a movable tongue or its equivalent to guide it on the proper wire. This may be counterweighted so that one wire can always be taken without any switching. But in the other direction the overhead tongue must be moved by external means—usually by a cord which runs down a pole, and which is pulled by an employee.

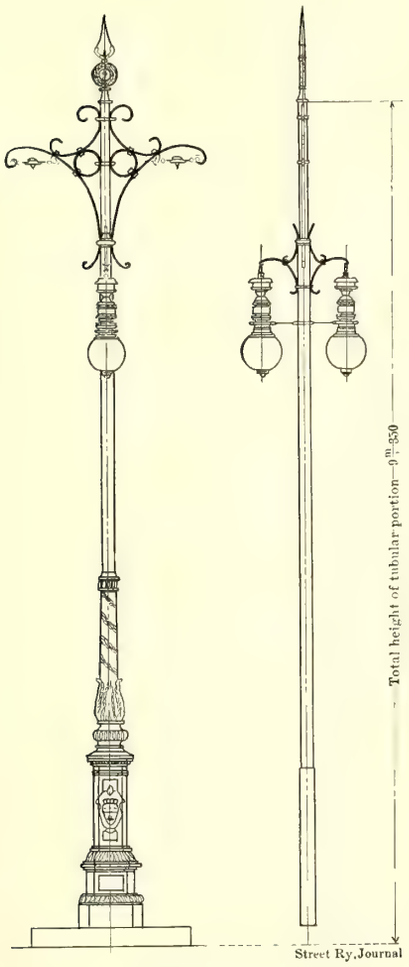


FIG. 15.—SIDE ELEVATION OF AVE. DUMESNIL POLE

Fig. 19 shows a rosette construction at Lourdes. The street here is very narrow, so much so that a flagman runs in front of the car to warn people to get into safe places while the car passes. Fig. 20 shows the construction of one form of these rosettes. They are very largely used in France. There seems to be no particular objection to their being anchored into the walls of private houses. In case of a refractory person, the threat of a pole before his property usually removes the objection.

The feeders are all underground cables. The insulation of these is of jute, paper or rubber—depending upon the price that is paid. The cables are almost invariably lead sheathed, and always armored. They are of French manufacture, and they are very well made. Wiped lead joints are not made, but junction boxes instead are employed. Drawing-in systems are practically unknown. The cables are laid in trenches of 60 cm (23½ ins.) depth, on

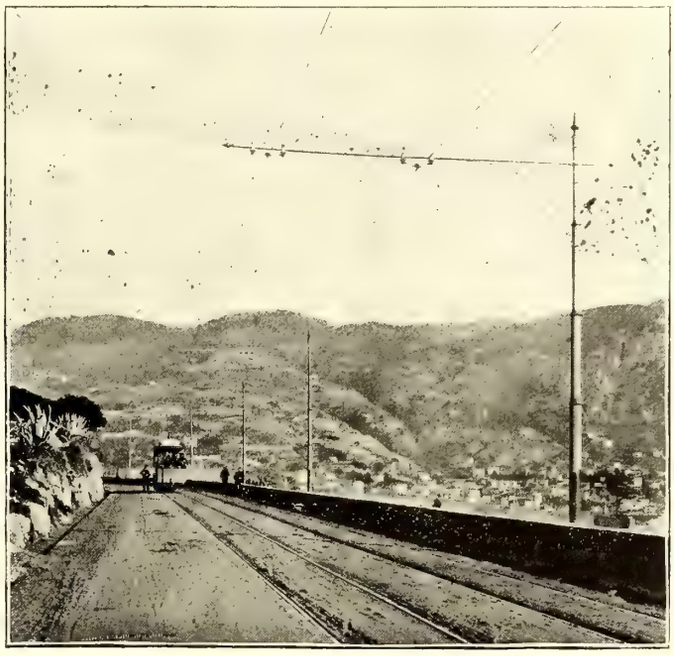


FIG. 17.—SIDE BRACKET CONSTRUCTION IN NICE

the bottom of which a layer of sand is first deposited; the cables on this are covered with sand, and then a wire netting is placed which is about 25 cm (19.8 ins.) wide. This latter is to warn workmen excavating that cables are laid close underneath. This is rather a rudimentary warning signal, and often the cables are damaged by a pick stroke before the workman discovers the netting. In and about Paris no cables can be laid in the street without being encased in an iron pipe. Therefore a cable laid under the sidewalk is protected only by the netting, but where it crosses a street it is laid in iron pipe, or if it is laid between

FIG. 16.—CENTER POLE CONSTRUCTION IN PROVINCIAL CITY

FIG. 18.—SIDE TROLLEY SIDE BRACKET CONSTRUCTION ON VINCENNES LINE

tracks for a tramway, the iron pipe is required the entire length. This is not a requirement in the provincial cities.

The writer will try to give a general idea of the conditions imposed by the authorities for electric tramways. There is now no one general law on the subject, but the one proposed by MM. Blondel and Dubois in their admirable work on electric traction will no doubt be adopted in its main features.

The installation of an electric tramway must be the subject of two official examinations or "enquetes," to use the expressive French word; the first is called that of public utility and the second refers to the underground and overhead electrical conductors. A preliminary project is submitted either to the Minister of Public Works, the Prefect or the Mayor, depending upon whether the concession demanded is national, departmental or communal, and this must contain the following:

1. The governmental map at 80,000 : 1 scale showing the projected route.

2. A general plan on a scale of 10,000 : 1 of the public routes followed.

3. A profile of the route on a scale of 5000 : 1 horizontally and 1000 : 1 vertically.

4. A cross-sectional outline of the rolling stock proposed, on a scale of 0.02 m. per meter.

5. Plans on the scale of 0.005 m. per meter of each crossing on the route of the proposed tramway.

6. A descriptive memoir giving the object of the enterprise, the estimated cost, the proposed fares, the kind of service proposed, the minimum radius of curves, the maximum gradient, the extreme width of rolling stock, the dispositions to be taken not to interfere with the access of abutting property owners to the public street, the minimum distance between the cars and the fronts of adjacent buildings—the extreme length and maximum speed of trains—the minimum number of trains to be put to the service of the public. These rules being defined by a law of 1881, before electric traction was thought of, the information is in reality supplemented by typical cross sections of the pole and overhead line. This "dossier" is examined and reported upon by every public service and private corporation which can be possibly interested in or affected by the proposed installation.

The Council of State, of which the titular head is the President of the Republic, finally issues a decree (assuming that the project is approved) declaring that it has examined these different reports, and that the project is one of public utility and its execution is authorized. The concession is granted according to the circumstances either by the State, Department or Commune, and the execution of the work is given by the decree either to the Minister of Public Works for the State, to the Prefect of the Department, or to the Mayor for the Commune. To the decree is annexed the formal agreement between the company and the State, Department or Commune as the case may be, which agreement includes conditions or specifications which vary, depending upon the proposed installation.

Taking as an example the concession given to the so-called penetrating lines into Paris, granted March 30, 1899, the conditions which may be of interest are as follows:

FIG. 19.—OVERHEAD CONSTRUCTION WITH ROSETTES IN LOURDES

The line of tramways in question is destined for the carrying of passengers, baggage and eventually express matter. This last to be subject to conditions to be mutually arranged hereafter between the government and the tramway. The traction will be by mechanical motors, overhead electric wires being only allowed outside of the city limits of Paris. The line will start from ———— and go to ———— on the following route. The following existing tracks on this route will be used. The plans will be presented two months from date, and the works will begin in four months, and be finished in one year from the date of commencement of work.

The extreme width of the cars must not exceed 2 meters and the

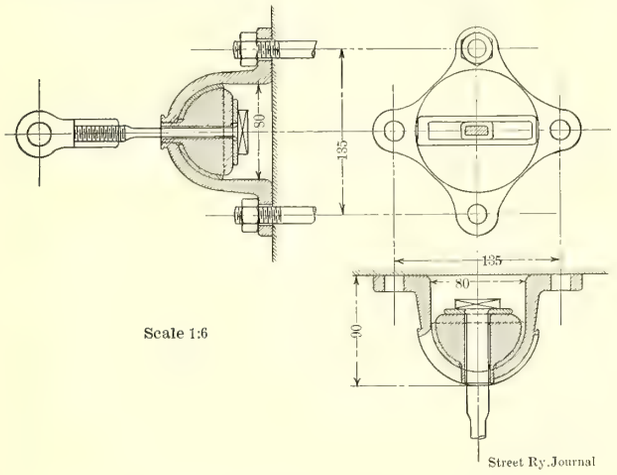


FIG. 20.—CONSTRUCTION OF ROSETTE

height 4.60 meters. The distance between two cars passing on double track must not be less than one-half meter. The maximum radius will be 18 meters. The paving will be either wood or stone upon foundations of concrete 0.15 meters thick and established at the cost of the tramway company. The surface to be paved will be the tracks, between tracks, and 0.55 meters outside of outer rails. An interval of 2.60 meters must be left between the car and the curbstone for the passage of wagons. If this distance cannot be given on both sides, the tracks will be brought near to one curb, leaving a distance of 0.30 meters between car and curb. The waste resulting from the tearing up of the street for the tracks will be made good by the use of new material at the cost of the tramway. Old material not used will be the property of the tramway. The work of tearing up the streets, putting down concrete paving foundations and the paving may be done by the city at the expense of the tramway company if the city so decides.

The rails will be full-grooved type, of a minimum weight of 40 kg per meter. The width of groove on straight track must not exceed 29 mm, and on curves 35 mm.

The drainage of the track to the sewers will be required. The cars can only take on and let off passengers at certain fixed points —to be determined after examination by the Prefect of Police.

The authorities have the power to prescribe waiting stations where, in their opinion, these may be necessary. The repairs necessary to keep the paving in, between and 0.55 meters outside the tracks in a perfect state of maintenance will be at the expense of the tramway company. Inside the city limits this may be done by the city if it so decides, but at the cost of the company.

If the construction or repairs of the road require any tearing up beyond the limits above mentioned, the paving repairs of such parts will be made by the tramway for a period of one year after their provisional acceptance as having been properly repaired. During the existence of the concession the company will bear any expense it may have to make to allow and facilitate regularly authorized work incident to changes or repairs of the streets and sewers on the public streets used by the company.

The minimum number of trips which must be made every day is ——. The authorities have the right to require an increase of this service. Trains shall not be composed of more than two cars—with maximum length of train of 25 meters.

The speed must not exceed 20 km an hour, and crossing streets this must be diminished to 16 km an hour. The number of second-class places must be double that of the first class.

The lighting and heating of the cars must conform to the demands of the authorities.

The duration of this concession will extend thirty years. At its expiration the city, department or State, as the case may be, will take possession of the tracks, power houses and all installations incident to the transmission of the power necessary to the operation of the cars.

In the five years preceding the expiration, the State will have the right to seize the revenues of the tramway and to employ

FIG. 21.—TYPE OF CAR USED IN ROUEN

them in putting in good condition the track and its appurtenances if the tramway company does not fill this obligation.

The cars, car depots, workshops, etc., remain the property of the tramway company, but the State reserves the option to buy them in totality or in part at a valuation fixed by experts, the material so taken to be paid for in six months. The State is required, if the company so decides, to take, at expert value, its

FIG. 22.—TYPE OF CAR USED IN VERSAILLES

spare material, fuel, etc., but the amount of such material shall not exceed that necessary for six months' operation of the tramway. The above dispositions are only applicable if the State decides that the tracks must be maintained in totality or in part. If the government should decide to the contrary, the tracks must be taken up in all or in part, and the streets put in their original condition by and at the cost of the company, and under the express condition that no indemnity can be allowed. The State also reserves the right to buy back the concession before its expiration.

The fares will be, in the city limits, 2 cents second class, and

3 cents first class. Outside of the city limits the fare is variable, depending upon the distance. Infants under four years and held upon the knees will be free. Non-commissioned officers and soldiers in uniform will have the right to first-class places on paying second-class fares. Packages, valises, etc., weighing less than 10 kg and carried without annoying other passengers, will be transported free. If required by the authorities, trains called theater trains leaving their terminus in Paris after midnight will be put on, double fares being charged.

The tramway company will put a special morning service of cars for workmen on all days except Sundays and holidays. Only

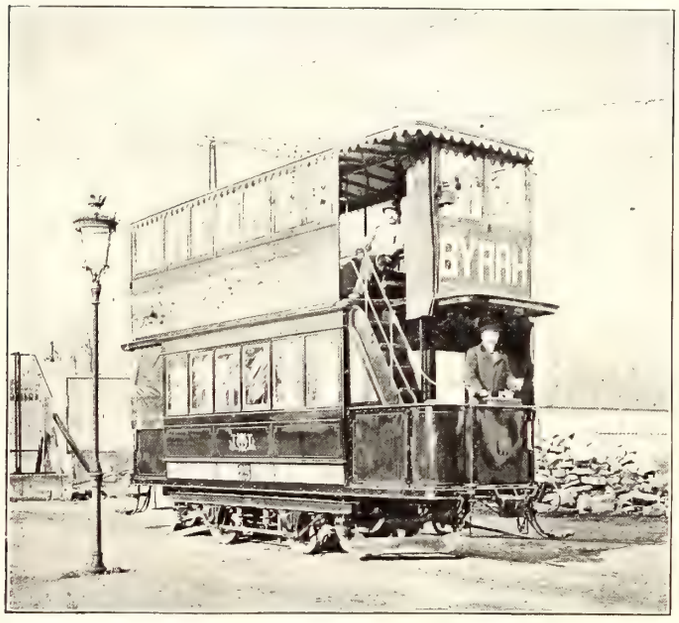


FIG. 23.—TYPE OF DOUBLE-DECK CAR USED IN LYONS

second-class places will be provided, and the fare will be one-half the regular second-class fare.

Passengers taking these trains will have the right to buy a ticket at the same reduced rate good for return evening trip. If another tramway line should be granted hereafter with the right to use a portion of the tracks hereby conceded to be built, no damages for loss of traffic or for right to use such tracks in common can be granted beyond a toll which shall be calculated on the basis of the car kilometers made by the respective companies on the common section of track, to pay the interest charge at 5 per cent of the cost of the common track, and the repairs and maintenance. The system of traction employed by the borrowing company cannot under any circumstances injure the operation of the present line. All expenses incurred to avoid such injury shall be borne by the borrowing company. The tramway company will not be forced to put at the disposition of the borrowing company the installation peculiar to its system of traction, nor to furnish electric current. Any agreement for a lower fare to individuals is forbidden, but this provision is inoperative for any agreement between the company and the government in the interest of the public, and to any reductions which may be made to paupers. Public officials and agents connected with the service of inspection of the cars and tracks will be transported free. The company must transport the mail under conditions and for remuneration to be hereafter agreed upon. Carriers of telegrams will be transported free to the limit of two for the same train. The company must pay f.75 annually per kilometer of track for the cost of the official service of control of tramways. Rents for the use of bureaus and waiting stations on the public streets will be paid for as provided by law. The right of standing cars in the public streets will be paid for at the rate of 6 cents for the departure of every car from a terminus situated in the limits of Paris.

The road must be operated so as to give every employee a vacation of ten days per annum, with free salary or wages paid for such time. Days lost on account of sickness, which is duly proved by a recognized doctor, will be fully paid for for a period not to exceed ninety days, and for a second period of the same extent this amount will be half pay.

In case of accident happening in the course of his work the workman will receive the amount fixed by law. The government can always demand such measures of security and health to the workman as it may see fit. The company will open with each employee an account with the National Savings Bank for a pension, retaining 2 per cent of each salary, to be so invested, and putting itself an amount equal to 6 per cent of each salary to the credit of the corresponding employee.

This resumé can be taken as typical of the conditions now imposed for concessions. The new features are those which pertain to the protection of the interests of the employees. The lately passed law for the protection of workmen in case of accident adds another very considerable safeguard to their material interests. The tendency now in France is to protect labor by legislation which may be thought to be Socialistic. The results will certainly be interesting and instructive.

The installation must also conform to the law of 1895, which has for object to protect the telegraph and telephone lines of the government. As in France the public telegraph and telephone service is a department of the postal service, it may readily be understood that this protection is rightfully considered of extreme importance by the government.

The articles of interest in this law are as follows: Overhead conductors cannot be established in a zone of 10 meters horizontal projection on each side of a telegraphic or telephonic line without a previous understanding with the service of post and telegraph. No conductor can be established above or below a public street without a permit given by the Prefect based upon the technical advice of the engineers of the service of post and telegraph, and in conformity with the instructions of the Minister of Commerce, of Manufacturers and of Post and Telegraph. A permanent

FIG. 24.—TYPE OF SINGLE-DECK CAR USED IN LYONS

electrical committee, one-half the members of which are composed of technical representatives of the important electrical works of France or works using electricity, is named by the Minister of Post and Telegraph to give advice upon the rules to be formed to carry out the intent of the law. Any electrical installation must be operated and maintained in such a manner as not to cause any trouble, by induction, leakage or otherwise in pre-existing telegraph or telephone lines. When the installation will require, to fulfil this obligation, the replacement or modifica-

tion of existing lines, such work will be done at the expense of the installing company.

The instructions given to carry this law in effect, so far as they interest electric tramways, are as follows:

1. The distance between an overhead conductor and a telegraph or telephone wire must never be less than one meter.

2. At crossings the possibility of contact between the conductor and telephone and telegraph wires must be rendered impossible by some mechanical disposition, or if this is not acceptable the service of post and telegraph will install special fuses on their lines at the expense of the installing company.

The totality of the overhead conductor system must give insulation resistance of 1 megohm per kilometer.

Underground cables must be at least 1 meter distant from parallel post and telegraph cables, and 50 cm from the same at crossing points.

The resistance of insulation between the conductors and the earth expressed in ohms must never be less than five times the square of the voltage of the distributing system measured at the poles of the generator.

The conductivity of the track must be assured in the best possible conditions. The drop in voltage of the track must not exceed 1 volt per kilometer.

The track must be insulated from a metallic construction, such as a bridge which it may cross. The connections must be such that the mean fall of potential for a day's run between the two extremities of such a metallic construction will not exceed one-quarter of one volt. It is forbidden to use the earth to form part of the circuit.

The above prescriptions are those having the sanction of law at the moment, but undoubtedly they will be modified and supplemented by a new law in the near future.

The signing of the decree does not give the permission to commence work, which must come from the Prefect after examination of the project of execution. Modifications or extensions proposed by the installing company or individual can only be granted by the authorized administration, but this authority has the right to demand without indemnity such modifications which experience or changes to be made upon the public routes should render necessary. The service of control takes charge of the inspection of the construction and operation of the installation, and the reclamation of all the other administrative services must pass by this one, which is the only one in direct touch with the work.

FIG. 26.—VIEW IN LOURDES, SHOWING TYPE OF CAR USED

FIG. 25.—TYPE OF CAR USED IN NICE

All this is rather complicated; it takes a long time to fulfil the administrative formalities before commencing work, and after that the right of the control to modify often hinders construction in an annoying manner, and makes it unduly expensive. This is due to the system and not to the personnel of the control. The engineers forming this service belong to the corps of "Ponts et Chausseés," in which only a limited number of the first graduates of the Ecole Polytechnique have the right to enter. The splendid theoretical training that they there receive, taken in connection with the "esprit de corps" of this renowned body of engineers, makes it, without exaggeration, the picked body of men of France.

To verify the drop in potential of the tracks the com-

panies install pilot wires, which depart from a special switchboard in the station to end at the track termini. These are often run by the service of post and telegraph on their overhead or underground lines by special agreement with the companies. These wires can be used also for private telephone purposes by the companies.

The cars used in the provincial cities of France are in general small and light.

Fig. 21 is a type of one in use at Rouen, Fig. 22 at Versailles, Figs. 23 and 24 at Lyons, Fig. 25 at Nice, Fig. 26 at Lourdes.

In some of these cities the cars are divided into first and second-class compartments. In general the first-class space is composed of an interior section of the car with upholstered seats. The second-class compartment has slat seats. The standing places on the platform are second-class also.

Fig. 27 gives the various views of the car for the tramway lines of Bordeaux. This car is one class only.

Fig. 28 shows a metal floor framing system. The use of iron or steel for the sills, cross-framing and platform knees, as here shown, is quite general in the construction of street cars, not only in France, but elsewhere on the Continent. The paneling is also generally sheet metal. The use of veneering for inside finish is almost unknown. The roof rafters show, and the under side of the narrow width roofing boards is varnished. The construction of monitor with re-enforced rafters, following the outline of the monitor, is now being largely adopted.

American cars have been imported to some extent, but this has been due principally to the long deliveries asked for by the French companies, on account of the congested state of manufacturing in France during the past year.

The cars are not handsome, but this is largely due to their restricted width over all; the cross section of Fig. 27 shows this clearly with the 1.770 meters over the sills,which the truck construction made necessary, and which, with any of the known types of trucks, could not be diminished much, if any—there is left only 0.115 meters, or about 6 ins. of swell for the car, the total extreme width over all being restricted to 2.00 meters. This—an average condition in France—explains the "boxy" appearance of the cars.

The cars made by the high-class manufacturers in France are well built, workmanship and material being excellent. There is quite a demand for cheap cars, which is catered to by second-grade manufacturers, and of these the least said the better.

In Paris the different types of cars in use are too numerous to mention. Some few examples only are given. Fig. 29 is a type of a double-deck car, which shows the upper deck closed for winter use; the side panels can be removed for summer use. The car will be equipped to run on a trolley and conduit construction, and also with a storage battery to run over a section of the route which is not provided with either of these sytems.

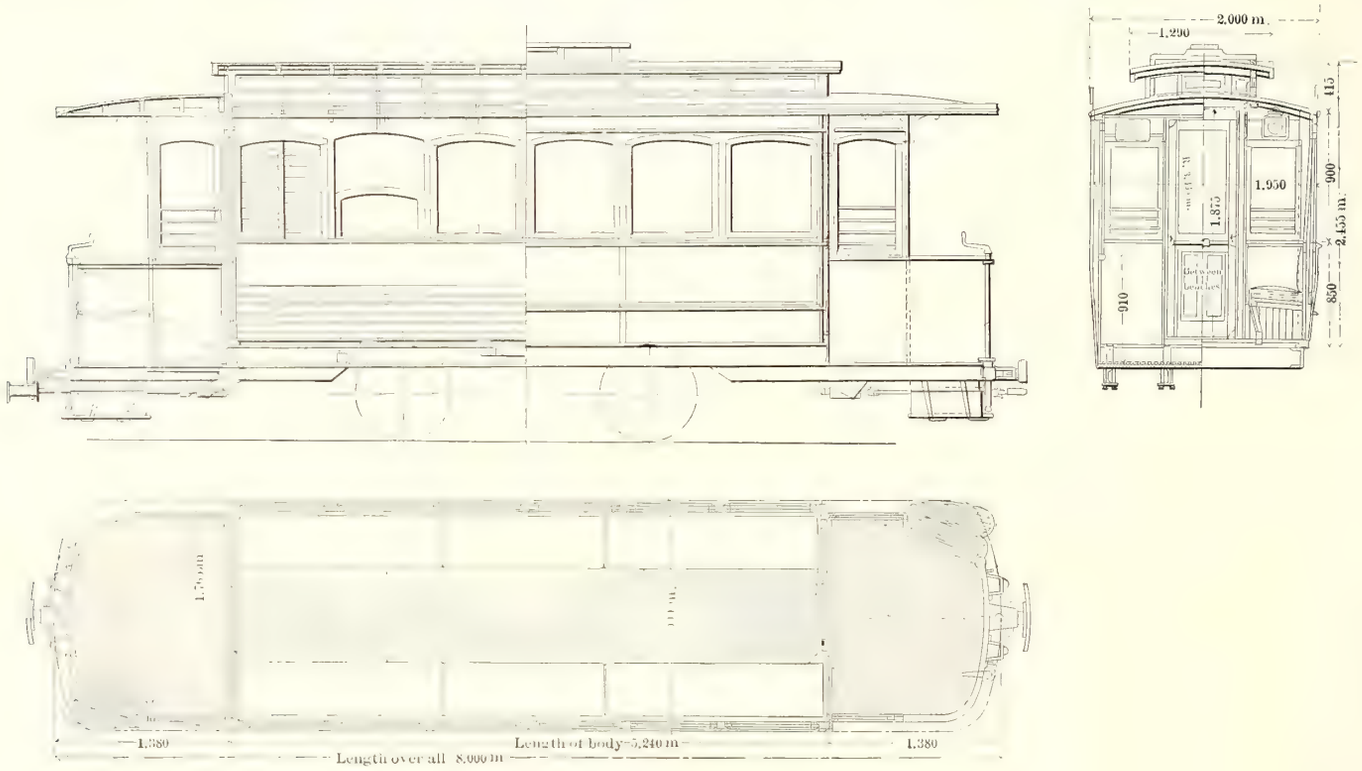


FIG. 27.—TYPE OF CAR USED IN BORDEAUX

Fig. 30 is a train of the Bastille-Charenton line. The motor car is provided with a plow, sections of the route being in conduit. The trailer is a good example of a European open car. Notwithstanding the beam construction of the sills these cars sag at the ends. The American construction of open cars is far superior. This is partly to be accounted for by the relatively small demand there has been for open cars up to the present time. When their advantages as means of attracting travel are more fully recognized no doubt the construction of such cars will receive more attention, and with beneficial results.

Fig. 31 is a train on the new conduit line in Paris, which has been constructed on some of the routes of the Compagnie Generale Parisienne de Tramways. The trail car is an example of a central platform car which is coming more and more in use in France, especially so in Paris. The construction is only practically possible with double trucks in the case of a motor car.

Trucks are largely of American manufacture. Those

built here are often copied more or less closely from American models, though there are two or three trucks of French manufacture which are quite distinct from any built in America. But it can be safely said that the greater American experience in truck manufacture is fully recognized with the result to give the preference to American types in most cases. But whatever the type of truck used it is quite certain that they will be constructed mostly in France—though certain pieces which are expensive, due to the high-priced special tools necessary for their manufacture, may be imported in considerable quantities.

The regulations of the service of control for the equipment of mechanically operated cars are very severe. They are constantly being made more severe in the search for the ideal car which never gives rise to accidents of any kind.

Before taking up the question of the safe operation of the car—a word as to the requirements in the construction of the car for the convenience of the passengers.

The cars are limited as to the number of passengers that can be carried. A passenger is allowed 45 cm (about 18 ins.) length of seating room. At one time the seat was restricted to a height of 33½ cm (a French engineer remarked that the half centimeter was a poem), but it was soon recognized that this height would not be acceptable, so it was increased to 43 cm.

The number of places allowed on the platform is determined by trial, a comfortable number being allowed without crowding. No passengers can ride on the front platform with the motorman. The front door must be kept closed, even in the hottest of weather, for fear that someone from the inside may distract his attention. Passengers wishing to reach the second-class compartment cannot pass through the first-class, but the contrary is permitted. Two-thirds at least of the total number of places must be second-class. These last two restrictions affect very seriously the design of a car, making it in many instances very difficult, and, in fact, only a center-platform, or a double-deck car can be readily adapted to these conditions. The windows must not lower more than 20 cm from the top, so that the passengers shall never be subjected to draughts. This restriction is extremely annoying in hot weather. With the front door closed, and the windows capable of opening only a few inches from the top the interior of a car becomes a furnace to be avoided at all hazards.

The requirements for brakes are very severe. Cars must

FIG. 29.—DOUBLE-DECK CAR WITH UPPER DECK CLOSED

be equipped with two systems—one in regular use and the other for emergency, in case of failure of the regular system. Each system must be sufficiently powerful to stop a car in 20 meters on a down grade of 2 per cent at a speed of 20 km an hour, without the use of sand. Naturally a dry or a clean wet rail is necessary—otherwise the condition is impossible to realize. If trailers are used the trial must be made with an empty motor car and a loaded trailer. Hand brakes are considered for emergency use, and the brake in regular use must be a power brake. This power brake must be capable of application from the rear platform independently of the motorman. This makes im-

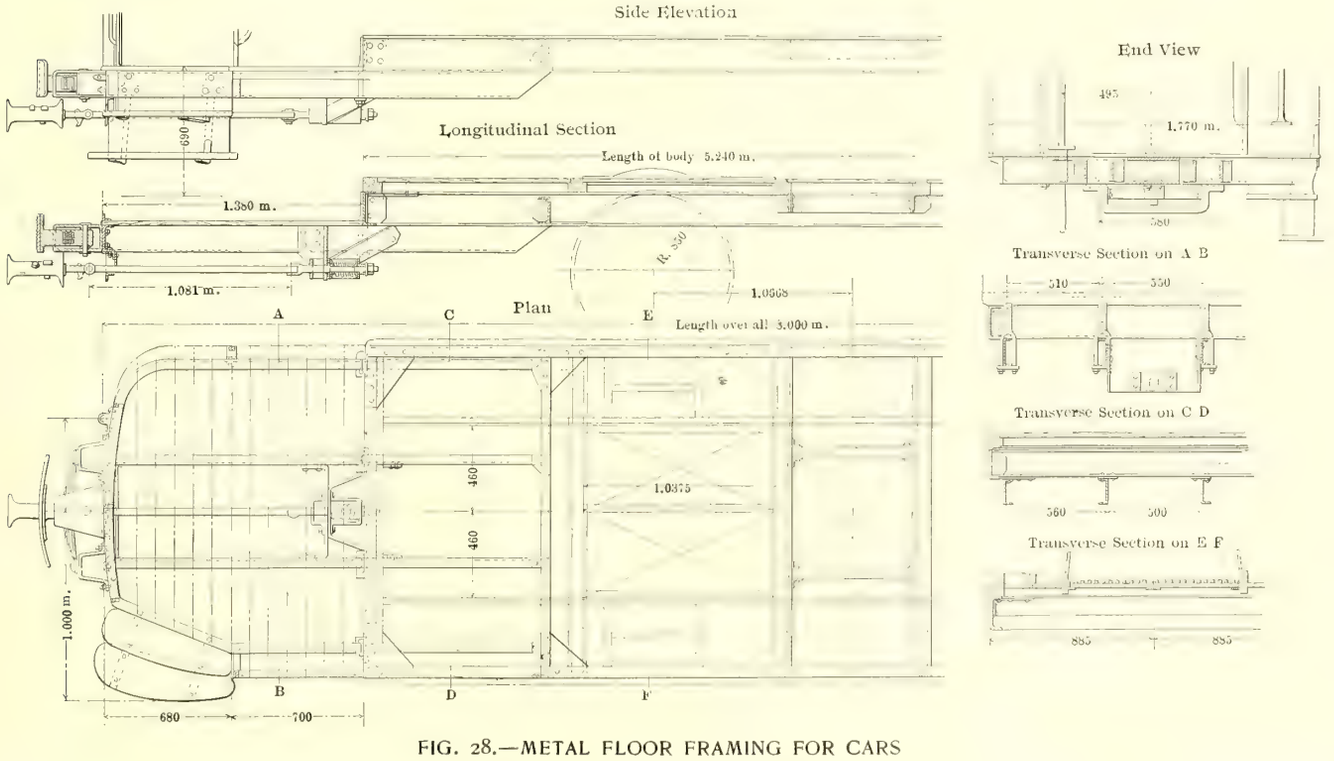


FIG. 28.—METAL FLOOR FRAMING FOR CARS

practicable the application of the electric brake as now constructed. Tramway companies in Paris have settled upon air brakes in some form or another as the only practicable system to fill the required conditions.

Three general types are in use on electric cars:

1. Stored air with charging stations at one or more points on the line.
2. Electric motor-driven compressors on the cars.
3. Axle-driven compressors on the cars.

All of the systems work well; but undoubtedly the first system is the simplest and requires less upkeep than the others. But it is not always easy of application, especially so with double-deck cars, where the room for reservoirs is very limited.

The second system is but little used on surface cars; it has been adopted, however, on the underground Metropolitan road.

The third system is extensively used on the new lines which have lately been put in operation. While it is too soon to say what difficulties in maintenance may be encountered later on, due to wear and tear, it cannot be denied that up to the present time the types of axle compressors in use, which are the result of long experience, are giving excellent satisfaction.

When trail cars are used, the requirements call for an automatic and "moderable" brake. This last means to be able to control perfectly the speed of a car on a grade by the brakes. This is difficult to do with what is generally understood to be an automatic system with the three-way valve, for, with this, to diminish the pressure on the brake shoes, it is necessary to release the brake entirely and reset it to the required pressure. Besides, a street car trailer fastened by a coupler and two heavy safety chains, as required here, is in practically no danger of becoming disconnected, and even if it should be there is always the hand brake to rely upon. The advantages of "straight air" for a street railway are so well recognized by the central engineers that they have permitted its installation with special devices to give the automatic feature in case of a rupture of the two cars. This requires two coupling tubes at each end of each car, with a chain to open automatically the valve which lets air in from the trail car storage cylinder to the brake cylinder. All this is an unnecessary complication, but it has to be done if one wants to avoid a three-way valve system.

When trailers are not used the motor cars have to be equipped in the same way as if they were used. The reason for this is that in case a car is "dead" for any cause, and is pushed in by another motor car, a man on the front platform can brake the two cars together regardless of the fact that the man who controls the power is on the front platform of the rear car. Each platform of the motor car must have a double reading gage, giving pressure in the air reservoir and the brake cylinder. A trail car must be equipped with one also for a conductor's use—though of what practical benefit this is it would be hard to understand.

Four sand-boxes are required. They must be connected in such a way that the motorman and the conductor can, independently of each other, sand in front of the wheels in whatever direction the car may be moving. For this two levers on each platform are required, but as the motorman has only two hands, which are otherwise occupied, a removable pedal is put in for his benefit, attached to the rods, sanding in front of the wheels while the car is moving forward. The motorman has under his control—alarm bell or trumpet, controller handle, air brake handle, hand brake handle, sand pedal for forward movement, and sand lever for backward movement of car, and two gage needles to look at. The conductor has two sand levers to use in emergency, and two gage-pressure needles to examine at his leisure. The conductor of a trail car has these latter also for his amusement. It is not to be wondered at that even with the very few mechanically operated cars now in service in Paris, serious accidents are of almost daily occurrence.

The proper maintenance of all these complicated "fixings" will be a most serious charge upon the tramway company. If the control spent less time in devising new complications to add to the cars, and more time in inspecting

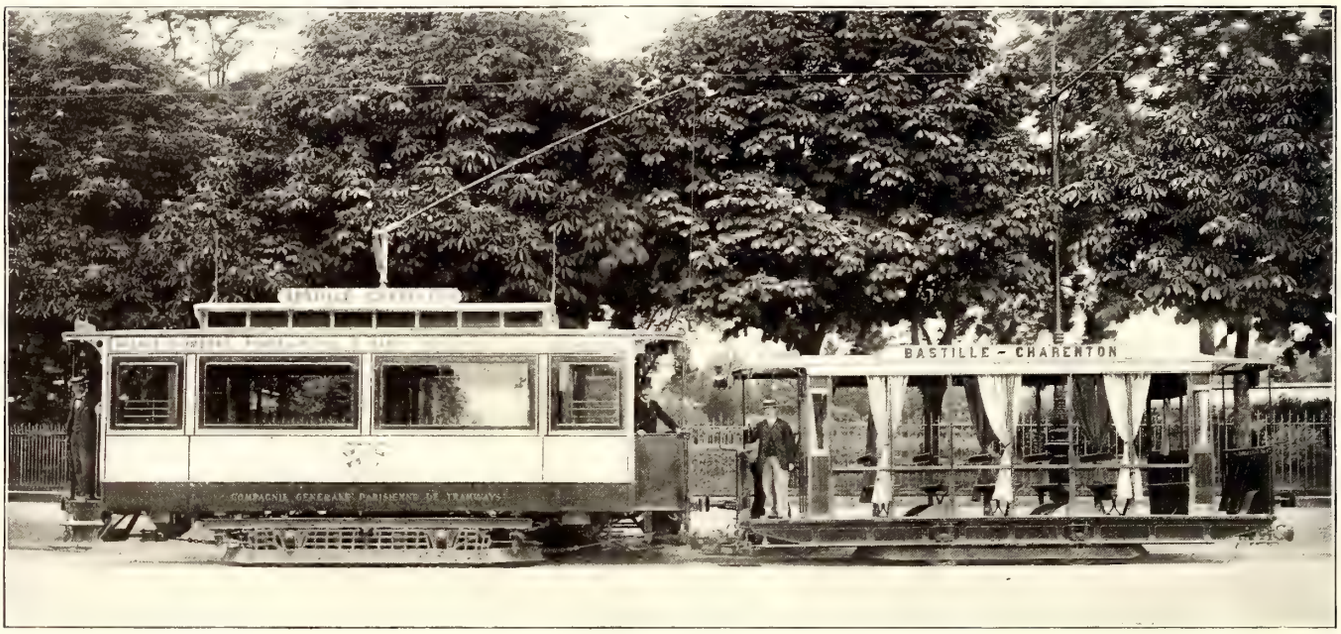


FIG. 30.—TRAIN ON BASTILLE-CHARENTON LINE

the operating condition of those already in use, it would not be a bold prediction that the result would be fewer accidents and a smoother operation of tramways in Paris.

The use of trail cars will undoubtedly very much diminish in Paris. The many operations necessary to couple and uncouple the two cars at the termini require an expensive equipment of men, besides the time required for these operations, added to that necessary for loading a car with "numerous" (order numbers), is such that the headway becomes too great to handle a heavy traffic. The abandonment of trailers, however, will be in line with the advanced street railway practice of the day. For Paris a long single-deck double-truck car, with central platform, fills the conditions of traffic requirements, with the exigencies of the control, in the most practical manner.

There is but little to be said about the electric car equipments. These have been largely of American manufacture, or, if built here, they have been, with but few exceptions, copied from American types. The local output of standard apparatus is taking such proportions that the home market will be supplied by French factories in a time not far distant. But for special apparatus, of which the amount required is limited, and for quick delivery work, it is probable that American manufacturers will continue to have the preference as in the past. The large use of American material can be traced to the fact that the strong French companies which have done most of the street railway transformation work, are commercially allied to the great American companies. The demand for material has been so great that the local manufacturing establishments belonging to these companies have been able to produce but a relatively small percentage of the total output. But this is changing now, as has already been said.

Power station practice is of no special interest in France. Small units for the unimportant tramways continue to be belted, but the important stations are now universally laid out with direct-connected generators. Boilers are usually parallel and close to the engines. French engineers generally use the "loop" system of steam piping; this, in their opinion being the best way to arrive at the advantages of a duplicate system. The piping is almost always of copper. Globe valves are in most general use even for larger sizes. It is strange that France should be so far behindhand in modern piping practice that an up-to-date job hardly exists.

The engines in use are almost wholly of French manufacture. In the early days of electric traction some few American engines were imported. But there are enough builders of good engines in the country to supply the present and probably any future demand. The best French engines are splendid examples of high-grade workmanship. They are designed especially with the view of giving the best possible steam consumption. The Corliss type of valve is much used. The governing mechanisms vary widely in type from those known in American practice.

Independent condensers are practically unknown; the prejudice against them on the score of uneconomical coal consumption is too strong to overcome their other advantages. Nearly all of the plants are condensing—the exceptions being too few to be considered. Cooling apparatus for the condensing water is so generally used that oftentimes no particular effort is made to locate stations near an unfailing supply of water. It is quite customary to drive wells for a water supply to supply the excess needed for the cooling apparatus. Various types of water-tube and return tubular boilers are in use. These need no description. Mechanical stokers have not been used up to the present time. The Babcock & Wilcox type of traveling grate is now being installed in a Rouen power house. The primary object of this is to comply with the desire of the municipality to reduce to a minimum the smoke nuisance.

Economizers are generally employed. Feed-water heaters are rarely installed in a condensing plant. Damper regulators are unknown—at least in the writer's knowledge. Fig. 32 is a view of the station of the Omnibus & Tramway Company, of Lyons. This was until lately the largest electric tramway station in France, but others, notably at Marseilles and Paris, have now passed it.

The limits of this article will not permit of an extended description of the installations which are of especial in-

FIG. 31.—TRAIN ON THE NEW CONDUIT LINE OF THE CIE. GENERALE PARISIENNE DE TRAMWAYS

terest; they must, therefore, be only indicated very briefly.

The opening of the lines in and about Nice is the first example here of a large system operated from an hydraulic station, and connected to transforming sub-stations by a long-distance three-phase transmission line. This gives a special interest to this installation, which will, undoubtedly, be followed in other places in the near future. This plant having been described in the July number of the Street Railway Journal, leaves no other comment necessary until the results of operation can be accurately known. The Potter surface contact system has been in operation for more than two years in Monaco. This was described in the May number of the Street Railway Journal. The only comment to be made is that this system has proved itself to be a "workable" one, and that for similar climatic conditions it could be safely installed.

The particularly interesting installations in Paris of surface street railways are those of the conduit and the Diatto surface contact system. The first was described by the writer in the December, 1899, number of the Street Railway Journal. The track work is about finished, and two

of the three lines are in operation. It is too soon to give any figures upon the operating expenses, receipts, etc. The service is rapidly becoming well organized, so that the best results should soon be had. The special construction features of the line have proved efficient and practical. Conduit lines are favorably regarded by the authorities. The extension of this form of electric tramways on a large scale is more than probable.

The "Diatto" system, which was described in the Street Railway Journal for July, 1899, has been adopted on nine of the new so-called penetration lines, or about 80 km of track. A portion of one of the lines from the Place de la Republique to the Opera House is in operation at the moment of this writing. It is evidently too soon to give any opinion upon the value of this system in such a city as Paris. That is was a bold undertaking to build so extensively in Paris on the basis of the small line operation in Tours is certainly incontestable. The "Diatto" system in Paris has a two years' lease of life, after which time it can be ordered to be taken out if it is not satisfactory to the proper authorities. This severe condition is usually imposed upon new systems.

The Metropolitan underground system has one of its most important lines in operation since July 19. As a long article was published on this line in the September issue of the Street Railway Journal, only a few words will be said of it here. Though the project of a great system of tunnel lines for city rapid transit has existed in various forms for many years, little progress was made before 1895, when the conflict between the State and city authorities came to an end in view of the pressing need of transit facilities for the Exposition of 1900. The last legislation necessary—that permitting the City of Paris to borrow the f.165,000,000 necessary—was passed in April, 1898.

The tunnels, viaducts, bridges, etc., are built by the city, and by it turned over to an operating company, which constructs the tracks and fits up the stations, supplies the motive power and rolling stock, and operates the road. The entire system is divided into six divisions, which will be delivered successively by the city to the operating company. The operating concession has a duration of thirty-five years for each division separately delivered. But this company will continue to operate the entire system until the expiration of the concession of the last division on the basis of an annual rental of f.45,000 per km, to be paid on those divisions whose time has expired. The city receives a percentage of the gross receipts, varying from 20 per cent to 40 per cent.

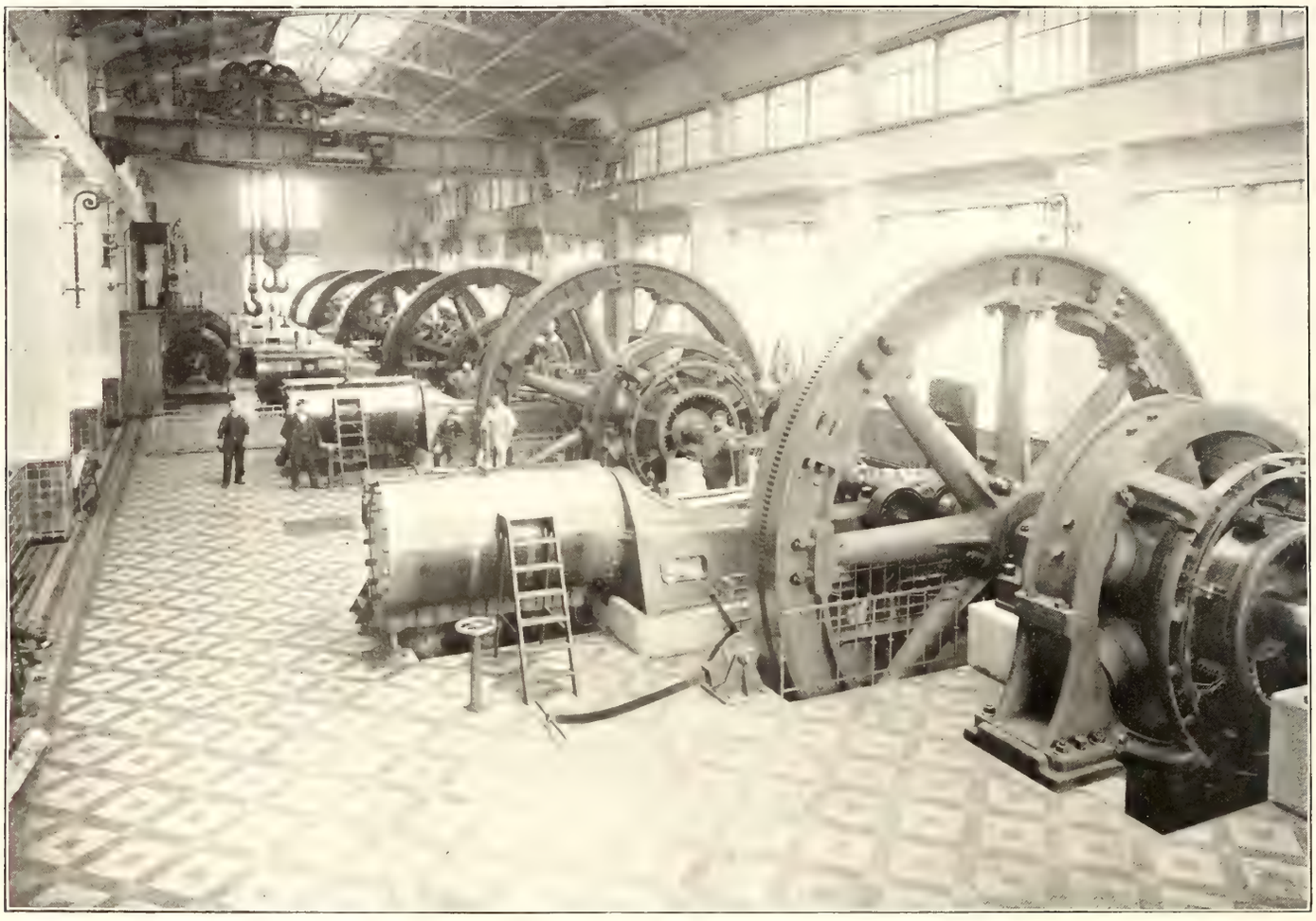


FIG. 32.—STATION OF THE OMNIBUS & TRAMWAY CO. OF LYONS

The Orleans railway is now in complete operation from the old station at the Pont d'Austerlitz to the magnificent new one on the Quay d'Orsay. This section is operated electrically by means of electric locomotives. The station is at Ivry, with two sub-stations, one each at the old and new stations. This installation, the first of its kind in France, is running very satisfactorily. About fifty trains are operated each way between the two stations, and this will in time reach eighty trains.

The electric installation of the West Railway will be very important, but it is hardly sufficiently advanced at this moment for a description.

THE DESIGNING OF LARGE TRAMWAY GENERATORS

BY HORACE F. PARSHALL

From a commercial point of view the process of dynamo designing may fairly be said to consist of determining the different dimensions so that some one abnormal condition, brought about by inconsistency of speed, current output or voltage, may be balanced against some other condition, so as to make the result as a whole satisfactory, although the individual constants chosen do not in themselves make for highest efficiency. I propose to limit the scope of the present article to the consideration of the designing of dynamos where there is no inconsistency between speed, voltage and current output, and where the individual values as to magnetic flux or electrical current are normal and make for highest efficiency. The surfaces of a dynamo are determined from thermal considerations. Particular dimensions, however, have reference to the magnetic limit of output. Experience has now become so extended that in the design of large generators the process can be greatly shortened by fixing in advance the efficiency as regards energy loss and allocating the individual loss to the several parts. Thus, for large street railway generators the efficiency may be taken to be between 94 per cent and 95 per cent, and the losses allocated as follows:

	Per Cent
C^2R loss in armature	2.25
Armature core loss	2.25
Field magnet loss	.75
Commutator loss, C^2R and mechanical friction	.75

The pole-piece loss is here included as a part of the core loss.

From the temperature rise per watt per square inch, as found in practice, and the permissible increase of temperature, the surface of the different parts for a given output is determined by the energy loss. The increase of temperature per watt per square inch at the periphery of an armature should be from 10 degs. C. to 15 degs. C. A 10-deg.-C. rise would be a very well ventilated armature; 15 degs. C. for one that is not carefully ventilated, and 12½ degs. C. is a good average value to assume for the purpose of calculation. This is at a speed of 2500 ft. per minute, which is normal, but calculations are not apt to lead to wrong results if the peripheral speed varies considerably from this result, since as between 2000 ft. and 3000 ft. per minute there is not more than 10 per cent variation of temperature rise. These figures refer particularly to the armature core, where the watt loss per square inch is about double that at the cylindrical end connections. In the normal case about 35 per cent C^2R loss is at the periphery of the core, and the remaining 65 per cent at the end connections. The above increase is by temperature thermometrically measured at the periphery of the armature. If the increase in temperature is to be calculated from the increase of resistance, the corresponding temperatures would be 15 degs. C. and 22 degs. C., respectively, measured from the increase of resistance of the armature as a whole.

In the field magnets, the temperature increase per watt per square inch external surface is about 60 degs. C. by thermometer and 120 degs. C. by resistance. In the commutator, the increase of temperature in the normal case is about 15 degs. C. per watt per square inch.

In the best practice it is the custom to limit the temperature increase of any part of a dynamo to 30 degs. C. by thermometric test, or 45 degs. C. by increase of resistance, the datum being 25 degs. C. Experience conclusively shows this to be a satisfactory value.

Hence, an approximate series of constants as to the requisite radiating surface for a given temperature increase per kw output can be fixed thus:

For the field, the radiating surface per kw output would be 15 sq. ins.

For the armature, the radiating surface per kw output would be 18.75 sq. ins.

For the commutator, the radiating surface per kw output would be 3.75 sq. ins.

Referring to the specific method of calculating, the C^2R loss in the armature needs no specific discussion, although it is the usual practice to limit the current density in large generators to about 1500 amps. per square inch, the rate of generation by heat at 40 degs. C. being 5.1 watts per pound loss in copper.

As regards the core loss, this can be calculated on assumptions from tests made on samples of iron as to hysteretic loss. Fig. 1 shows results of such tests on good commercial sheet steel. In practice, however, it is more expedient to establish a curve as shown in Fig. 2.

In the process of calculation of the core loss, the effect of distortion, which in good practice may increase the maximum density 30 per cent, should not be lost sight of, since the loss in the projections and core increases very considerably with such an increase in density. In a well-designed dynamo I should expect the densities to be taken so that the average loss in the armature core is less than 1 watt per pound.

Referring next to the commutator, with carbon brushes the current density should not exceed 40 amps. per square inch at full load. The contact resistance varies considerably according to the condition of the commutator, but a good average result is .03 ohms per square inch of contact, in other words, there may be 1.2 volts drop from contact resistance at full load. An ordinary pressure of contact is 1.5 lbs. per square inch, in which case at a peripheral speed of 2000 ft. per minute the mechanical friction is about 50 per cent of the C^2R loss.

As regards the losses in the field magnet coils, these have been given in extent. It is usual to calculate the amount of copper, assuming 600 amps. per square inch current density. Seven hundred and fifty amps. per square inch is commonly accepted as the limit in good practice in large generators.

Referring next to the design of the field magnets, it may be remarked that the function of the field magnets may be considered that of supplying at minimum cost of magnetic and electrical material, a magnetic flux of a certain magnitude and stability and the maximum armature reaction permissible, which is determined by the conditions of commu-

tation. In the normal dynamo circuit, the following values at no load and full load are typical of a steel field-magnet, multipolar dynamo:

NO LOAD

	Percentage of total m. m. f.	Densities (C. G. S. lines per sq. in.)	
Armature core	2.75	60,000	
Teeth	5	120,000	Apparent
Air-gap	70	40,000	
Magnet core	12	80,000	
Yoke	10	65,000	

FULL RATED OUTPUT

	Percentage of total m. m. f.	Densities (C. G. S. lines per sq. in.)	
Armature core	3	60,000	
Teeth	12	138,000	Apparent
Air-gap	60	46,000	
Magnet core	15	102,000	
Yoke	10	75,000	

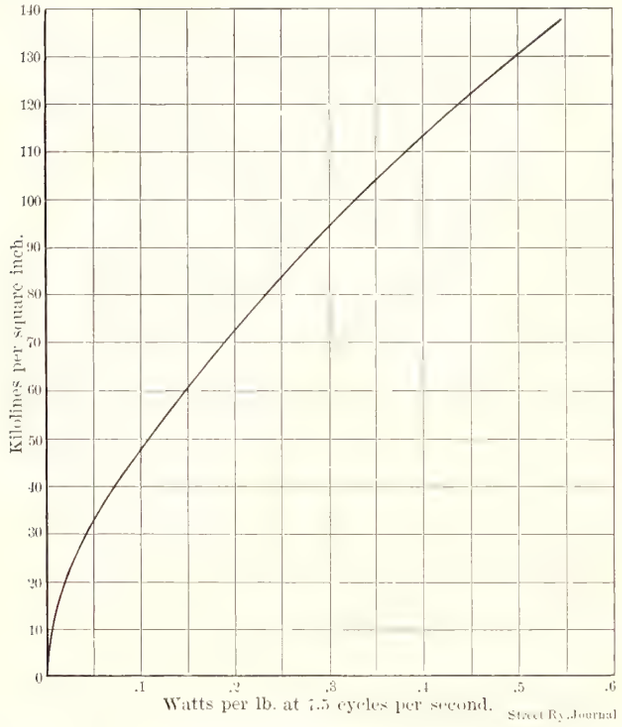


FIG. 1.—TESTING LABORATORY VALUES FOR HYSTERESIS LOSS IN GOOD COMMERCIAL SHEET STEEL

It will be noticed that nearly 80 per cent of the total m. m. f. is concerned with reference to the conditions to be maintained in commutation. The most economical densities in the field magnetic circuit will, of course, vary somewhat according to the relative market value of iron and copper. The surface of the field magnets, assuming reasonable depth of winding as stated above, is determined from the C^2R loss, the increase of temperature per watt per square inch and permissible increase of temperature. The cross section of the field magnet cores is determined particularly with reference to the magnitude of the magnetic flux and the most economical density. The magnetic flux is, as stated above, fixed from the maximum permissible armature reactions, and the density from the properties of the materials. The general dimensions, therefore, of the magnet coils, as to length and diameter, are within the limits of good practice determined by these factors. The amount of copper in the field magnet coils can be conveniently calculated from the following formula:

$$\text{Weight of copper per spool} = 31 \times \left(\frac{\text{Ampere feet}}{1000}\right)^2$$

Curves 3, 4 and 5 show the magnetic properties of commercial wrought iron, cast iron and cast steel. The cores should always be of wrought iron or steel, but the yoke may be of cast iron or steel, according to the market value of material. Laminated poles have not been a particular success, since they tend to make the flux at the pole face unstable as to surging on change of load from the coils under commutation.

The leakage or ratio of effective to maximum flux varies somewhat, but with large ring multipolar dynamos does not exceed 15 per cent, which may be safely assumed in calculation. Their leakage does not increase more than 20 per cent between no load and full load, or 3 per cent of the total flux, so, with normal magnetizations, does not greatly influence the amount of compounding.

The number of poles with multiple circuit armature windings is determined by the maximum armature reac-

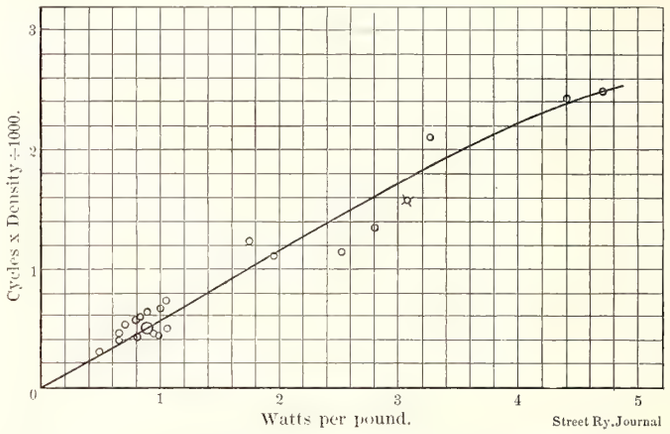


FIG. 2.—CURVE EXHIBITING THE RELATION BETWEEN CYCLES PER SECOND × KILOLINES DENSITY BELOW SLOTS ÷ 1000 AND WATTS PER SECOND IN ARMATURE CORE, BASED ON OBSERVED RESULTS IN TWENTY-THREE LARGE MULTIPOLAR COMMUTATING MACHINES

tion consistent with commutation, the minimum number of commutator segments, and the maximum permissible reactance of an armature coil, and the greatest economical contact resistance, and is therefore determined from the condition determining the maximum current which can be collected at a set of brushes, which in the kind of practice under consideration does not exceed 300 amps. at rated capacity.

MAGNETIC LIMIT OF OUTPUT

The limit of output of a commutating dynamo from a magnetic point of view is determined from the maximum value; that having regard to heating can be assigned to three independent variables. The first has reference to the m. m. f. underneath the pole piece, acting to produce distortion in the air gap, the amount of distortion being determined, as was shown by Hopkinson, by the m. m. f. under the pole piece (equal to the number of conductors multiplied by the current) and the magnetic reluctance around which this m. m. f. acts. The amount of distortion can be limited by making this reluctance comparatively great, and in the case of projection armatures can be made to increase very slowly with the m. m. f. or current in the armature by making the initial magnetization in the projections high, so that the reluctance increases greatly with the increase of magnetic density.

Secondly, the resistance of the collecting brushes, which, with dynamos with brushes at fixed lead for variable load, plays a most important part. Since the reversing field is only of proper value for one current output, this resistance

acts (1) to prevent abnormal current when the coils are short-circuited in strength of field not corresponding to the current output, (2) to increase the rate at which the current falls off in the coils when short-circuited, and (3),

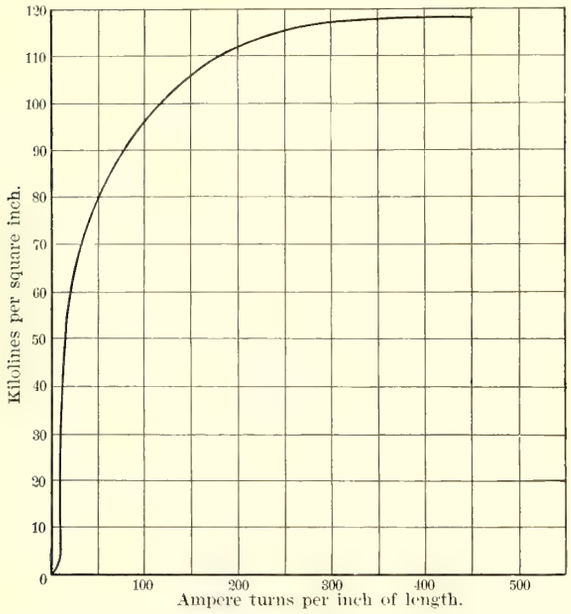


FIG. 3.—CURVE FOR GOOD QUALITY OF WROUGHT IRON AND SHEET STEEL

to shunt into a short-circuited coil a portion of the reverse current, so that on leaving a brush the current is in phase with the current in the main circuit. The contact resistance may be varied according to the quality of carbon used, which varies from 590 x 10^{-6} ohms per cubic inch to 3900 x 10^{-6} ohms per cubic inch, but in ordinary practice it is found advisable to limit the contact resistance so that the

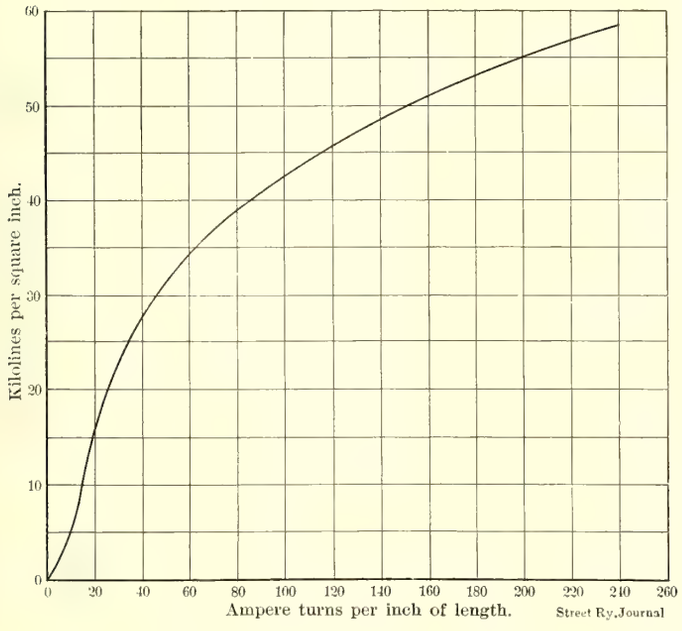


FIG. 4.—CURVE FOR GOOD QUALITY OF CAST IRON

drop in the brushes at full load amounts to not more than $\frac{1}{2}$ per cent, otherwise the commutator becomes excessively large and costly and efficient collection difficult.

Thirdly, the self induction of the individual armature coils, which is a measure of the maximum field strength required for current reversal, as also the amount of distortion produced locally in the line of commutation, this distortion being backward for diminishing current, and forward for increasing current. This inductance voltage, which may be calculated from the laws of the magnetic circuit or on the basis of 20 c. g. s. to 25 c. g. s. lines per ampere per inch length of armature iron, has been limited in value in terms of the volt drop in the brushes, with full load current density, and in terms of the average strength of magnetic field as expressed by the average voltage in the commutator segments under a pole piece. Neither method by itself is entirely satisfactory theoretically, but practically

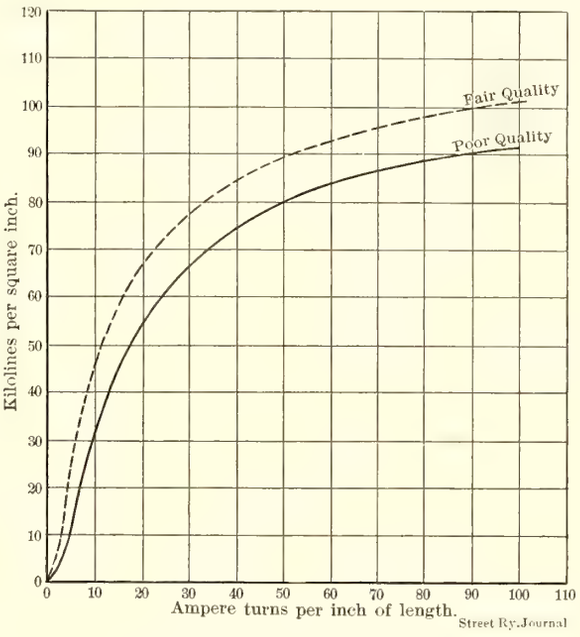


FIG. 5.—CURVES FOR CAST STEEL

the results are fairly consistent when the calculated inductance voltage does not exceed three or four times the drop in the brushes at full load or require more than one-third average strength for reversal. The self inductance acts at no load to prevent the generation of abnormal currents in the short-circuited coils, but at full load acts to prevent commutation, not necessarily by setting up a magnetic field, since this may be nullified by the m. m. f. of the field magnets, but by distortion of the magnetic field so that the current in the coils is not properly reversed as it passes from under the collecting brush into the open circuit position. The frequency of commutation varies in ordinary practice from 200 cycles to 300 cycles per second. The reactance voltage is a measure of the damage that can be done by a coil when not in proper field strength, and may therefore be increased if the contact resistance be increased to a corresponding extent.

The absolute frequency of the reversal is dependent on the distribution and strength of the reversing field. In practice the brushes generally cover three and a half commutator segments and are moved forward to a position such that the self-induced field at approximately full load is overcome by the field of the field magnets. With the inductance limited as above the light load induced currents in the short-circuited coils will not be more than one-quarter or one-fifth of the full load current. The limiting value for distorting m. m. f. is determined by the initial magnetizations, consistent with heating in the projections and conductors, but results of practice indicate that the m. m. f. acting under the pole piece should not exceed two and one-half times the entire m. m. f. of the magnetic cir-

cuit, or seven and one-half times the initial m. m. f. acting in the air-gap and teeth. As will be seen, however, from the observations made *re* the influence of highly magnetized projections and latitude in ventilation, these projections can vary widely.

As regards compounding, in good practice the pole pieces cover about 80 per cent of the circumference of the armature. The strength of the reversing field as given above corresponds in a projection armature to a position of the brushes approximately up to the pole, in which case the power of the armature for demagnetization is the number of conductors between the poles multiplied by the number of amperes in each conductor.

The length of the armature being determined by the inductance per unit of length and the total permissible inductance, this dimension divided into the surface gives the diameter. The remaining dimensions follow from the various constants set down above.

The number of commutator segments follows from the inductance per coil, and the maximum permissible armature reaction. The thickness of the brushes is determined from the contact resistance and the width of the magnetic zone of approximate uniformity, generally corresponding to the thickness of three to four segments. Thick brushes lessen the frequency of commutation, hence *inter alia* the advantage of shaping the pole pieces so as to have the reversing zone as wide as possible.

By the courtesy of E. W. Rice, Jr., I am able to give the following particulars of a generator designed by the engineers of the General Electric Company a number of years ago. It was particularly remarked at the time that the various constants were ideal from a designer's point of view. The practical results in the working of the generator have been so satisfactory that it may be fairly stated that this dynamo attains as near perfection as is possible in commercial practice.

DESCRIPTION

Number of poles	10
Kilowatts	550
R. P. M.	90
Terminal volts, full load	550
Terminal volts, no load	500
Amperes	1000

ELECTRICAL

Armature—Terminal volts, full load	550
Total internal volts	569
No load volts	500
Number of circuits	10
Style of winding	Single
Times re-entrant	Singly
Total parallel paths through armature	10
Conductors in series between brushes	180
Type of construction of winding	Barrel wound
Number of face conductors	1800
Number of slots	300
Number of conductors per slot	6
Arrangement of conductors in slot	3 wide x 2 deep
Resistance between brushes, 60 degs. C.	.0125 ohms
CR drop in armature at 60 degs. C.	12.6 volts
CR drop in brush contact surface	2.4 volts
Total CR drop	19
Amperes per square inch armature conductors	1560

COMMUTATION

Volts Between Segments, average	6.1
Armature turns per pole	90
Amperes per turn	100
Armature ampere turns per pole	18,000
Lead of brushes (number of segments)	9
Lead of brushes (per cent)	10
Demagnetizing ampere turns (per cent)	20
Demagnetizing ampere turns (per pole)	3,600
Distorting ampere turns per pole	14,400
Frequency of Commutation, cycles per second	254
Coils short circuited together per brush	3
Turns per coil	1
Turns short circuited together per brush	3
Conductors per group commutated together	6
Reactance Voltage, one coil (volts)	3.9

MAGNETIC

Megalines, from one pole no load and 500 volts	1.85
Coefficient, of magnetic leakage	1.125
Megalines in one pole, no load	2.08
Megalines in one pole, full load	2.36
Armature—Density no load (kilolines)	59
Density full load	67
Ampere turns, no load	190
Ampere turns, full load	320
Teeth—Apparent density, no load (kilolines)	108
Apparent density, full load (kilolines)	123
Corrected density, no load (kilolines)	108
Corrected density, full load (kilolines)	119
Ampere turns, no load	340
Ampere turns, full load	900
Gap—Density at pole face, no load (kilolines)	42.5
Density at pole face, full load (kilolines)	48.5
Ampere turns, no load	5,000
Ampere turns, full load	5,700
Magnet Core—Density, no load (kilolines)	78
Density, full load (kilolines)	88
Ampere turns, no load	880
Ampere turns, full load	1,530
Yoke—Density, no load (kilolines)	69
Density, full load (kilolines)	79
Ampere turns, no load	640
Ampere turns, full load	1,000
Saturation ampere turns for no load and 569 internal volts	9,450
Total ampere turns for full load and 550 volts	12,350

The density in the core = 67 kilolines.

$$\frac{C \times D}{1000} = \frac{7.5 \times 67}{1000} = .50$$

and from the curve the value of .88 watts per pound is derived for the specific weight of dissipation of energy in core loss.

The total weight of sheet iron in the armature = 12,600 lbs.

Hence, core loss = 12,600 x .88 = 11,100 watts.

The experimentally observed value was 11,000 watts.

THERMAL CALCULATIONS

Armature—

C^2R loss at 60 degs. C. = $1{,}000^2$ x .013 = 12,600 watts.

Core loss, 11,000 watts.

Total loss in armature at full load = 23,600 watts.

Peripheral radiating surface of armature = 12,000 sq. ins.

Watts per square inch of peripheral radiating surface	1.97
Peripheral speed of armature (feet per minute)	2250
Observed rise in temperature after eight hours' full load run, as determined by thermometer on armature surface	26 degs. C.
Observed rise determined from increase in armature winding resistance	38 degs. C.
Thermometric temperature rise per watt per square inch *peripheral* radiating surface	13 degs. C.
True temperature rise per watt per square inch *peripheral* radiating surface	19 degs. C.
Spool Windings—Total C^2R loss per spool at 60 degs. C.	422 watts
Total external cylindrical radiating surface of one field spool	1350 watts
Watts per square inch of external cylindrical radiating surface	.312
Observed increase of temperature by thermometer on surface of shunt winding after eight hours full-load run	26 degs. C.
Mean rise of thermometer	19 degs. C.
Thermometric temperature rise (mean) per watt per square inch of radiating surface	61 degs. C.
Rise of temperature by observed increase in resistance of shunt winding	45 degs. C.
Rise of temperature by observed increase in resistance of series winding	31 degs. C.
Mean rise of temperature of spool winding from resistance measurements	38 degs. C.
Terperature rise by resistance measurements (mean) per watt per square inch of radiating surface	122 degs. C.

COMMUTATOR LOSSES AND HEATING

Commutator—Amps. per square inch contact surface	40
Brush resistance positive and negative	.0024 ohm
C^2R loss at brush contacts, watts	2400
Peripheral speed, feet per min.	2040
Total watts lost in commutator	3670
Radiating surface, square inches	2400
Watts per square inch radiating surface	1.53
Observed rise of temperature after eight hours' run at full load	22 degs. C.
Observed rise of temperature per watt per square inch of *peripheral* radiating surface	14.5 degs. C.

THE ELECTRIC RAILWAY MOTOR

BY JOHN LUNDIE

The immediate function of the electric railway motor is to convert electrical energy taken from a contiguous supply into mechanical energy, and deliver it from its armature shaft.

A consideration of the motor *per se* should be independent of how potential is maintained or is changed between the motor terminals. In other words, we assume a definite potential between the motor terminals, say, 500 volts, except as this potential difference is arbitrarily controlled on the external circuit during the starting of the motor. That a motor may not seem to do its work, or even be seriously abused by fluctuation of potential difference between its terminals, may be no fault of the motor, any more than would a steam engine be at fault in performing its work unsatisfactorily, or in pounding itself to pieces under a violent fluctuation of load, or of steam pressure, beyond the range of the compensation allowed for. Fluctuations of supply of energy to a motor are just as much to be guarded against, or provided for, as are sudden changes of load. Much mechanical injury may be done to rolling stock and its equipment by insufficient means of energy supply; for instance, by the sudden shutting off of current from one car or train, while another car or train thereby has the potential difference raised at the terminals of its motors. The operator may prevent continued excessive flow of current through the motors by means of his controller, but he cannot prevent the sudden shock to the machinery and cars, not to mention passengers.

In considering the electric railway motor, we may thus leave out of consideration any line questions bearing on sufficient energy supply, or any questions bearing on control, except as it varies the potential and consequently the flow of current, with resulting speed.

In seeking a motor for a specific railway service, it is primarily necessary to define the duty which it will be called upon to perform. Generally, a motor may be said to be required to deliver energy in such a way and at such a rate as to propel a certain mass, consisting of rolling stock and its live load, over a given track in a given time. This, however, is subject to many modifications. The amount of energy delivered to give this mass the required movement is dependent upon the work to be done against track and air resistance, in overcoming gradients and in giving motion to the mass at every start. The time in which the various elements of the total work to be done is performed determines the rate of expenditure of energy or the varying power to be exerted by the motors.

The service for which electric motors are best suited, in the present state of the art of locomotion, is that of fulfilling the requirements of municipal or suburban traffic, where short headways and frequent stops are called for. In order that satisfactory speed may be made with such a service, it is necessary that the method of acceleration and braking receive the closest attention. In any given run between two consecutive stops there is an absolute limit of speed, determined by acceleration and braking; the higher the acceleration and rate of braking, the greater the possibility of speed. Not only must this be borne in mind, but what appeals more forcibly to the railway manager when duly appreciated is the fact that in any given run between two consecutive stops in a given time it is easily possible to consume much more energy by wrong method of running than would be consumed by correct ones. Two hypothetical limits of method of running are:

First. Accelerating to a speed S almost instantaneously, as might be done by taking hold of a cable without any elasticity; running uniformly at that speed, and stopping against a bumping post.

Second. Accelerating uniformly to a speed $2S$ and immediately uniformly braking.

In both cases the same distance would be traversed in the same time, and approximately the same amount of energy expended in overcoming track, air and gradient resistance. The energy expended in the second case in giving motion to the mass would, however, be four times the amount in the first, being proportional to the square of the speed. Neither is an advisable method of running, but they illustrate why it may be possible to consume much more energy by one method of running on the same average speed than by another.

Again, to illustrate from actual running methods where the same maximum speed may be attained in a given run, we may accelerate rapidly to a given speed and "coast" until it is time to brake from the low speed the train has reached through resistance of one kind or another. On the other hand, we may accelerate slowly so that the train reaches the same speed as before just at the time we must apply the brakes in order to make our stop. In each case the same distance over the same track is made in the same time with the same maximum speed, yet more energy is required to make the movement in the second case than in the first. This is readily appreciated when we consider that in the second case we throw away all of the kinetic energy of the train in braking, while in the first case it is utilized to a great extent in overcoming train resistance, a limited amount only being dissipated in braking, corresponding to the square of the speed at which the brakes are applied.

It is thus properly in order to attack the problem of car movement and the method of making it with consideration of the varying amounts of energy required under different methods of operation, before turning to a consideration of the motor best suited for performing the service.

When we do turn to a consideration of the motor, we find that economic conditions react on the methods of making different movements, so that we must see our railroad problem in every phase before we can decide how best to equip with "motive power;" indeed, we may decide not to operate electrically at all, under certain circumstances. Assuming, however, that ours is essentially an

electrical proposition, we have in a careful consideration of the questions indicated determined the average work required of our motor, and also the varying rate at which it must perform the work. On the basis of these determinations we are in a position to specify a suitable motor for our service.

The maximum demand for power will almost invariably be during the period of acceleration. Adhesion between the driving wheels and the rail—which may be estimated at 15 per cent of the weight on the drivers—will, with given gearing and wheels, determine the maximum permissible current. When such a speed is attained as corresponds to this current at line voltage—say, 500 volts—all resistance being cut out of circuit, then the motor is giving its maximum output of power. Working at a given constant traction (which may be the limit of adhesion, or less) requires a practically constant current; but, until counter electromotive force builds up by the speeding up of the motor, resistance must be introduced into the circuit to prevent an excessive flow of current, which would simply slip and grind the wheels, provided the requisite current estimated on produced exactly the torque giving the limit of adhesion at the rims of the driving wheels. Self induction on the first influx of current plays a useful part in modifying a jerky start. No satisfactory method of potential control has yet been devised except that of series-parallel operation, which saves, utilizes or stores the energy necessarily lost by the introduction of resistance into the circuit during the operation of the controller.

When a series motor has the full-line potential between its terminals after the operation of the controller is complete its speed, as a rule, continues to increase, and the current correspondingly decreases, dependent, however, upon the frictional or gradient resistances to car movement which are encountered, preserving a balance of speed and corresponding current; the power represented by the torque and speed of the armature being equivalent to the product of the counter electromotive force generated therein and the current then passing. A variation in the amount of power called for, such, for instance, as reaching an ascending gradient, immediately tends to retard speed, which in turn permits an increasing flow of current, preserving the mutual balance above mentioned. This balance between speed and current characterizes the operation of series-wound motors as distinct from the comparatively constant speed with varying current of shunt-wound motors, and, for many reasons bearing on railway operation, renders the former class of motor preferable to the latter for the nature of work called for by the present field of operation of electric traction.

A word on the application of motors to a railway vehicle. There is no excuse for a vehicle being heavier than is justified by the nature of the freight it has to carry and the modifications called for by the speed at which it has to travel. It is freight that pays and not dead load. Again, there is no excuse for trying to have the motors develop traction at the rims of the driving wheels greater than the co-efficient of adhesion between the wheels and the rails. In this connection, what may be called the "purchase" of a motor equipment, or the relation between the torque of the armature and the traction produced thereby at the rims of the driving wheels, should receive the closest attention. A given motor may be geared for any reasonable speed of car with the same power development at the armature shaft; but as the measure of power output at the rim of the wheel is the product of the traction and the speed, it follows that in order to procure traction, speed (with the same motor) must be sacrificed, and vice versa. On short runs, therefore, where we must pick up to a moderate speed quickly, it is necessary to use a low-speed gearing, whereas as the length of run between stops becomes longer, rapid acceleration is not so important, and we can better afford to use a higher speed gearing. As a rule, it is a high *average* speed that is desired in railway operation. This is too frequently confused with a high maximum speed.

Having sketched the duty required of an electric motor applied to railway traction, the specifying of the motor for the work to be performed becomes comparatively simple. As with all machinery, the selection of a motor begins with the assurance that it will deliver the mechanical energy at the rate required from its armature shaft. Next we desire the conversion of electrical energy into mechanical energy to be as economical as possible, all things considered. Finally, we desire the fatigue of the motor reduced to a minimum. It could hardly be considered the function of the railway manager to enter, in his specifications into a discussion of the metallurgy or the physical, magnetic and electrical properties of iron, steel and copper, or to discuss from the standpoint of a physicist the properties of insulating materials, except as such may appreciably affect the strength, operation, efficiency or life of the motor; nor is it necessary to display his knowledge of Ohm's law, magnetic flux or induction effects. The motor designer may be credited with being thoroughly conversant with such matters. What the motor designer does want to know, however, is the *direct* duty the motor is required to perform. This information is radically different from presenting to the manufacturer the whole railway problem to solve from his commercial standpoint as the seller of apparatus. This not uncommon practice has as much reason in it as would have the railroad manager who would rely upon the builder of steam locomotives to solve his transportation problems.

The principal elements of the duty a motor has to perform are:

First.—The maximum output of power required, determing the maximum current required, on line voltage.

Second.—The general cycles of variations of power required, giving the intermittent or continuous current requirement and also its average during continued service operation.

This information, together with that of space limitations, will govern dimensions of parts calculated to withstand the static and impact stresses indicated; it will determine the range of current throughout which commutation must be satisfactory; it will partially determine brush and commutator areas and the amount of copper required in the windings.

As the principal elements of duty a motor has to perform are classified under two distinct heads, so the limitations of capacity of the motor to perform this duty may be classified under two corresponding heads, viz:

First.—The capacity to commutate.

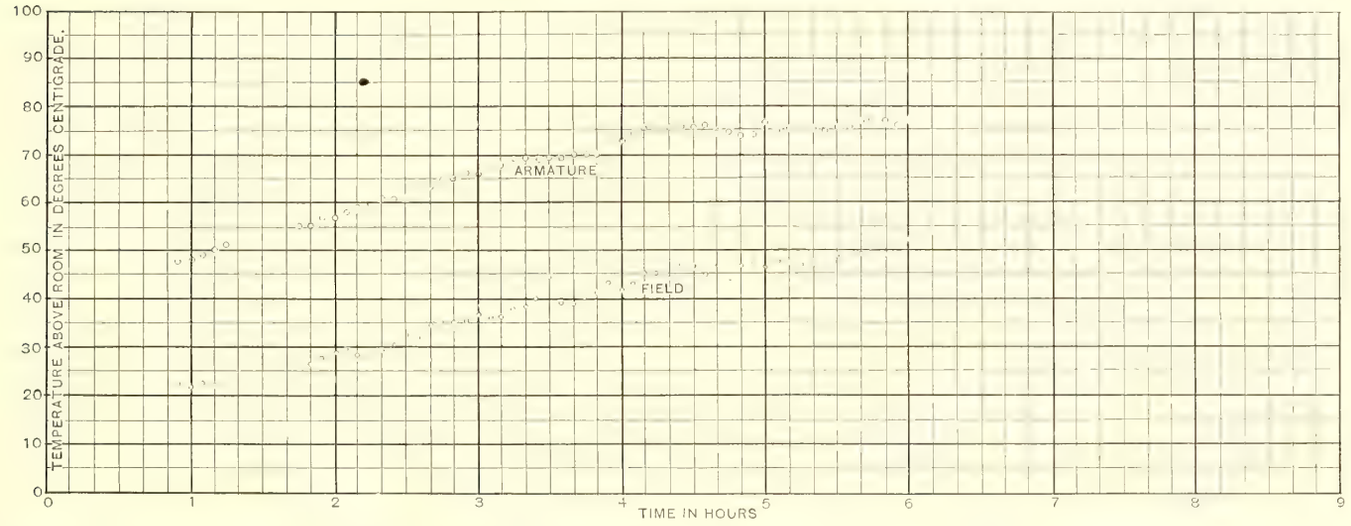
Second.—The capacity for fatigue.

The commutation limitation is definite and needs little

comment. The capacity for fatigue of a motor is limited first by the mechanical fatigue to be provided for by careful mechanical dimensioning and facilities for proper lubrication. In service, it might be added, inspection and cleanliness will do much to add to the life of the motor. The latter points, however, can only affect the specifications for motors indirectly.

THERMAL TEST OF RAILWAY MOTOR X
RUN A 1
100 AMPERES. 60% OF TIME. 5 MIN. CYCLE.
Average Room Temp. 22.5°C.
Average Voltage 500
Average Speed 820

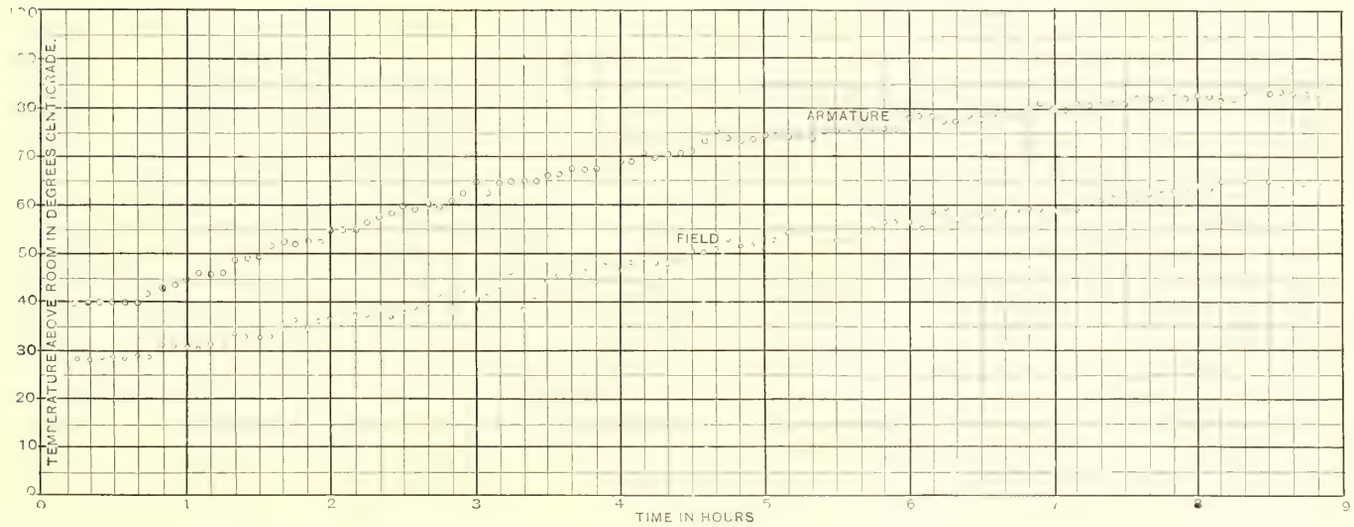
Current for Resistance Readings:			
	Armature	59 Determinations	
		84 Average Amps.	9.2 Average Seconds
	Field	59 Determinations	
		62 Average Amps.	12 Average Seconds



The fatigue of a motor due to heating is the most troublesome to provide for, and at the same time is inseparable from motor operation. Deterioration of insulation limits the temperature at which the metal in a motor may be operated; thus, the prescribed limitation of temperature may well receive careful consideration. The committee on standardization of the American Institute of Electrical Engineers evidently had not time to consider fully the temperature limitation which ought to be placed on the railway motor, as while recommending a maximum temperature elevation on commutating machines of 50 degs. C. on field and armature coils, measured by resistance, the very significant remark is made: "In apparatus built for conditions of limited space, as railway motors, a higher rise of temperature must be allowed." This, of course, begs the whole question.

THERMAL TEST OF RAILWAY MOTOR X
RUN A 2
150 AMPERES. 40% OF TIME. 5 MIN. CYCLE.
Average Room Temp. 22°C.
Average Voltage 501
Average Speed 690

Current for Resistance Readings:			
	Armature	104 Determinations	
		78.4 Average Amps.	10.5 Average Seconds
	Field	104 Determinations	
		58.5 Average Amps.	14.7 Average Seconds



On account of the high temperatures induced in the windings of motors otherwise operating satisfactorily in actual railway service, the selection of insulating material calculated to withstand high temperatures without undue deterioration has received attention at the hands of manufacturers. Asbestos insulation and mica supported by fiber are used for this purpose in several types of motors on the market. The use of mica (being non-absorbent of moisture), provided the fiber packing is such as will prevent too much movement of the coils within the armature slots, would seem to meet the requirements of insulation calculated to withstand high temperatures. Here, however, we may encounter a difficulty tending to offset the advantages of the insulation, namely, that it may appreciably prevent the dissipation of heat.

There are two methods bearing on motor design by means of which temperature may be reduced:

First.—By increasing the amount of copper in the windings, so reducing the $I^2 R$ generation of heat; also by reducing the facilities in the iron for heat generation from induced currents therein, by lamination, slotting, etc.

Second.—By facilitating the dissipation of heat as it is generated.

The dissipation of heat may take place by convection, by conduction and by radiation. Ventilation will facilitate dissipation by convection. Radiation is tributory to convection and conduction, the latter probably playing a not unimportant part in the dissipation of heat from the armature; the heat in the coils radiating to the core, and this heat, with that generated in the iron of the core, having a metallic path to a lower temperature. In this connection, some methods of construction calculated to reduce iron losses may so reduce the above mentioned metallic path for the heat as to result in retention of heat near the armature coils which might otherwise be dissipated by conduction.

Accepted practice seems to point to about 100 degs. C. as the limit of temperature to which the windings of a railway motor may be heated without producing immediately appreciable deteriorating effects. This will permit of a temperature rise of about 75 degs. C. above atmosphere at 25 degs. C. Insulation experts may yet prove that this temperature may be exceeded with ultimate economy, even though a gradual deterioration does take place; and as the railway motor is a hybrid at best we must not be hypercritical, provided we are convinced by the maintenance account that higher temperatures may be safely maintained with economy. Be this as it may, the temperature limitation being granted at say 75 degs. above the atmosphere, we may base our acceptance of motors on such an arbitrary limit.

The heating of field coils is principally from $I^2 R$ losses, and for this reason they ought to have sufficient copper so that under no circumstances of load should they govern the maximum temperature conditions.

With the armature governing the conditions of maximum temperature we have a combination of $I^2 R$ and core heating, which throughout the range of current used in service operation together, may constitute practically a constant percentage of the input. This being the case, so long as the same average input is used in continued intermittent service, it will be a matter of indifference whether this average is impressed at a high or a low input, provided the current remains within the defined limits of operation, so far as average generation of heat is concerned.

If then the rate of heat generation in the armature is a constant and the rate of dissipation is a function of the difference in temperature of the windings and the atmosphere, then a temperature must ultimately be reached on continuous intermittent work which will cause dissipation of heat at the same rate at which it is generated. This temperature is that already referred to as the advisable limit on account of deterioration of insulation.

Essentially the following method of railway motor rating, based on the above, has been proposed by the writer:

The power rating of an electric railway motor under actual conditions of operation on frequent intermittent load should be directly proportional to the average current input, independently of variations in current, except as the current may be governed by the limitations of satisfactory commutation.

Expressed otherwise, a motor can be readily rated as follows:

T = percentage of time the motor is operated on any current I. Then within the limits of current required, as hereinbefore discussed for service operation:

$\Sigma T \times I$ = motor rating in time-current units.

The integration of the product of current and percentage of time being a constant.

As an instance, a motor might be rated at 6000 time-current units to operate in service between current limits of 100 amps. and 250 amps. This motor on continued intermittent service ought not to have a greater temperature rise than the one agreed upon whether operating on 100 amps. 60 per cent of the time, or on 250 amps. 24 per cent of the time, or on any combined products of current and percentage of time integrating 6000 units.

THERMAL TEST OF RAILWAY MOTOR X

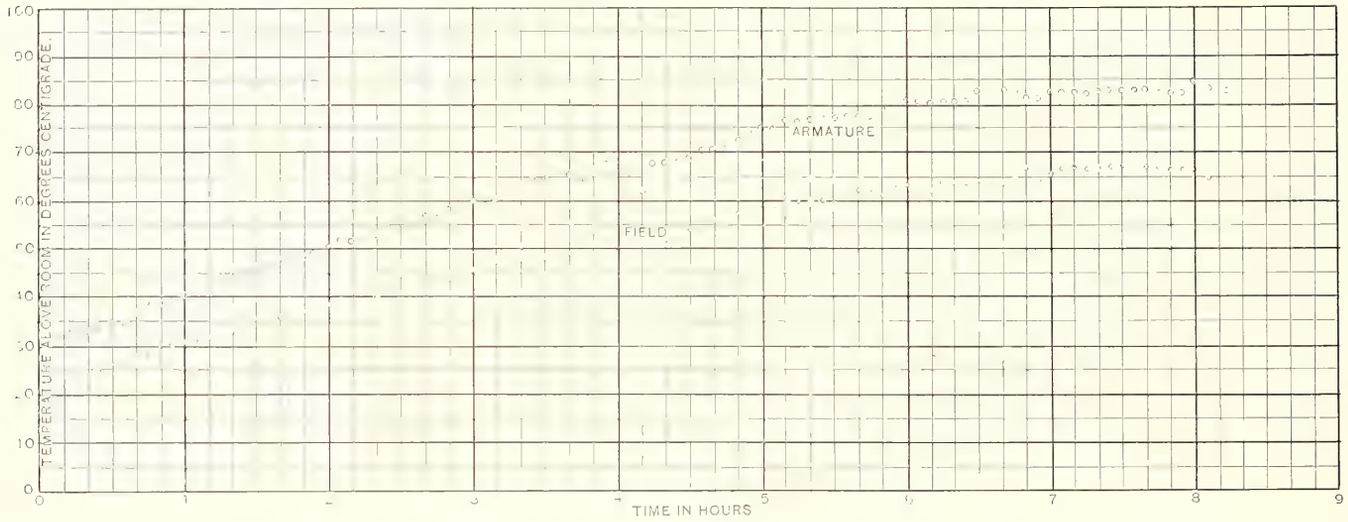
RUN A 3

200 Amperes. 30% of Time. 5 Min. Cycle.

Armature 107 Determinations

Current for Resistance Readings: 82.5 Average Amps 10 Average Seconds; 107 Determinations; 60 Average Amps. 12 Average Seconds

Average Room Temp. 18°C.
Average Voltage 500
Average Speed 625



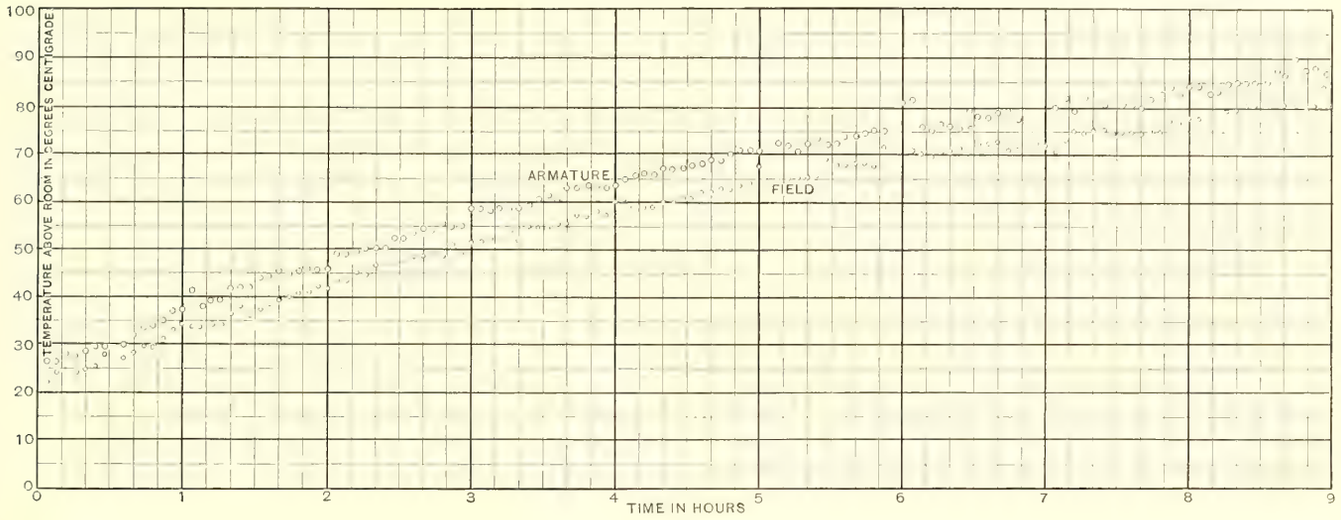
In testing, the total time of any cycle of test should be such that the temperature will not drop appreciably during the portion of the time that the current is off, this being the method of operation referred to as continued intermittent service.

designated "X," showing temperatures attained in field and armature, as measured by resistance, on the intermittent loads given in the above example. Whether or not this motor may properly be rated at 6000 time-current units may be judged from the temperature curves. Further

THERMAL TEST OF RAILWAY MOTOR X
RUN A 4
250 Amperes. 24% of Time. 4 Min. Cycle.

Average Room Temp. 22°C.
Average Voltage 500
Average Speed 580

Current for Resistance Readings: Armature 128 Determinations 79.5 Average Amps. 7.6 Average Seconds
Field 131 Determinations 60 Average Amps. 11.5 Average Seconds



Objection may be made to stationary tests of a motor on this basis that service operation is calculated to induce better ventilation; also, that with varying conditions of starting on the rheostat, the core heating will differ from that produced by the same current at line voltage. To both

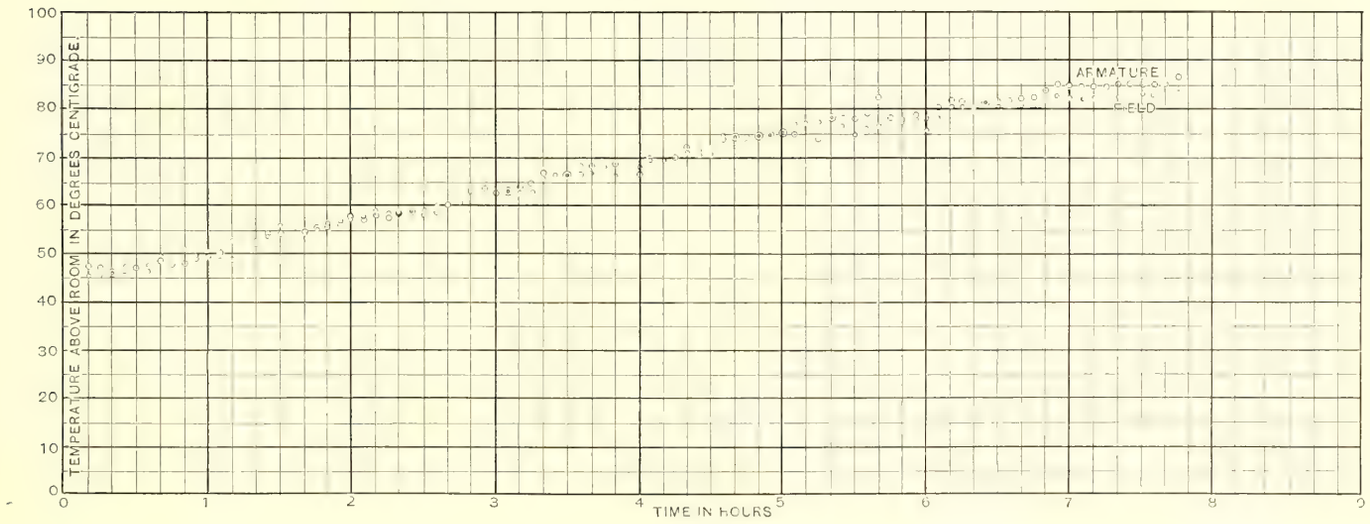
comment on these tests would necessitate reference to specific professional work, which at present is undesirable.

The advantage of such a motor rating as has been proposed would simplify the selection of motors for specific service, for the following reasons:

THERMAL TEST OF RAILWAY MOTOR X
RUN A 5
300 Amperes. 20% of Time. 5 Min. Cycle

Average Room Temp. 22°C.
Average Voltage 500
Average Speed 545

Current for Resistance Readings: Armature 91 Determinations 16 Average Amps. 6.7 Average Seconds
Field 91 Determinations 56 Average Amps. 10.4 Average Seconds



of these objections may be given the general answer that if the motor will stand the shop test, then service operation on the average current ought to produce heating within the temperature limit, which certainly cannot be objected to.

The writer has had occasion to subject several railway motors to such a seriesw of tests, and submits herewith the results of a series of runs on a motor, for obvious reasons

First.—The rated capacity of the motor would be directly proportional to the average current required at the motor, being the average current multiplied by 100 in time-current units.

Second.—The sum of the operating motor capacities expressed in average current at cars would equal the load on the station after making due allowance for the modifications due to series-parallel operation and for line losses.

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The importance of the convention at Kansas City this year and the extent of the street railway industry justifies the publication by us this year of an "International Engineering Number." The contributors to this issue are all eminent the world over as authorities on the subjects on which they treat, and, as the broad principles of electric railroading are the same in all quarters of the globe, the discussions will be equally useful to the railway manager in America, Europe, Asia and South America.

* * * * * *

American methods are shown clearly by the typical installation in Kansas City. Although the system there is not so large as that which other cities of greater population can boast, it is far greater than in cities of similar population abroad, and the recent electric equipment is modern and in accordance with the latest American practice. Figures are given of the cost of operation of the power station, which show that it ranks exceedingly high in the economy of its production. The park business has been well developed, as the various views in the first article amply testify, and the track and rolling stock are in excellent condition.

* * * * * *

How the methods employed in street railway engineering are modified to suit French conditions is the subject of the second article in this issue, by A. N. Connett. Mr. Connett reports that greater care is taken in France to secure a tasteful overhead construction than in America, and the methods followed, as well as some of the designs of details and overhead work submitted, are worthy the serious consideration of American managers. The statement is also made that mechanical traction has supplanted horses in the larger cities of France, with the exception of Toulouse and Paris, and that in the former city the delay has been due to local conditions, and will disappear within a few months. Mr. Connett is an authority on the subject treated by him, owing to his long residence in France, and seeing, as he does, through American eyes, his conclusions carry great weight.

* * * * * *

The subject of electric generators for street railway service is discussed by Horace F. Parshall. Mr. Parshall has treated this subject from a new point of view; that is, he has assumed an efficiency. That this is warrantable is apparent when we consider that the commercial value of a generator is determined by its efficiency; from the efficiency, of course, the losses are known. Mr. Parshall then proceeds to locate these losses in accordance with the best established practice, and from the constants assumed obtains the surfaces of all the parts. As the surface is determined from two dimensions, if one of these dimensions can be determined by some other feature, the dimensions of the generator as to length of armature field magnets, etc., are obtained. Mr. Parshall determines these dimensions in respect to the magnetic limit of output, particularly in regard to the self-induction and the maximum current per pole, consistent with the proper thermal conditions of highest efficiency. He then gives as an example the principal data of a 550-kw machine, which he has selected as a model.

* * * * * *

Mr. Lundie takes up a description of the electric motor. He first shows that a study should be made of most economical method of train operation, the effect of different accelerations, brakings, etc., being considered. These having been determined, the engineer must take up the capacity and durability of the motor for work; in this consideration, the ability of the motor to withstand heat is one of the most important factors. He then discusses a method of rating the horse-power of railway motors, which, he argues, on frequently intermitting loads, should be proportional to the average current input, independent of the variations in the current. This will be found contrary to the usual practice, but Mr. Lundie has long been an advocate of it, and brings many arguments to sustain his position.

* * * * * *

The broad principles of rolling stock is the subject next taken up, by H. H. Vreeland, president of the Metropolitan Street Railway Company, and the thread of argument is continued by Thomas Millen, master mechanic of the same company, who describes in detail the four standards used by the company in New York, with certain devices which they have found convenient in car construction and operation. Mr. Vreeland's paper is really more than an article on cars, for he treats on general traffic conditions and the best methods of handling them. While he expressly limits himself to the conditions existing in New York City, all that he says on the subject is valuable, as much of the practice of New York City is eminently suited to other cities' service.

* * * * * *

Mr. Clark devotes himself in his article to a study of financial conditions and methods of promoting companies

abroad. He shows that these do not differ greatly from those in this country, and that foreign bankers are alive to the financial possibilities of the street railways, not only of their own country, but in America as well. Mr. Clark is a careful student of street railway finance, and his article will be read with much interest.

* * * * * *

The polyphase situation is summed up by Dr. Louis Bell, who has given special attention to this branch of electric railroading. Dr. Bell not only treats of the latest American practice in polyphase distribution, but also refers to the use of polyphase motors for railway work, and gives some particulars of the work of an American company in this direction. Heretofore the activity in this line has been confined almost exclusively to Swiss manufacturing companies, but with the wider experience gained in the use of polyphase motors, their application for commercial work in this country seems not so very far distant.

* * * * * *

Three foreign tramway systems are described: The Berlin elevated railway represents the latest practice in Germany in this branch of engineering, and views are given of the structure, which show that æsthetic conditions have been borne in mind by the engineers in charge of the work. The tramway system of Rio de Janeiro has never before been described. While the city seems naturally well suited for tramways, the different sections being separated from each other by high hills and mountain ranges, electricity has not played any considerable part in the service as yet, and only a short portion of the system is electrically equipped. Finally a typical British installation is shown in the case of the Carlisle tramways, with its double-decked cars and other characteristic features.

* * * * * *

In this issue also a most valuable set of figures is made public for the first time in the table showing in detail the operating expenses, total and per car mile for the past year, of the cable and electric systems of the Metropolitan Street Railway Company, of New York. That the change of the Broadway line from cable to electric power is justified is clearly shown by this comparison, and to the managers of the company is certainly due the gratitude of all others engaged in electric railroading, for the generosity with which this company has presented its detailed operating expense sheet to the public.

* * * * * *

Finally, a brief sketch is given of some of the important Americans who are managing tramway affairs outside of the United States. This will be a surprise to many, who, while aware that many workers in this field have taken up residence across the water, have not realized the extent to which this has been done, or the influence exerted in tramway affairs by American engineers and managers. In this connection it may not be amiss to bear in mind that this predominance of Americans in the world's tramway affairs, up to this time, has been due, in large part certainly, to a practical absence of competition in the manufacture of tramway apparatus in all countries outside of Germany and possibly Austria. That this will not continue in the same degree, however, is evident from the energy with which the British manufacturers, not to mention those of other countries, are entering the field. There are already at Preston, in Lancashire, works for the manufacture of electrical apparatus and cars, which rival in appointments and capacity some of the largest in this country. Other important companies in England are also acquiring or increasing their facilities for the manufacture of electric railway apparatus. We believe that the growth and extent of the business during the next ten years in all parts of the world will certainly be sufficient to tax all the manufactories of this class of machinery, as well as those projected, but it is certain that in many classes of apparatus American makers will no longer have the same monopoly abroad that they have heretofore enjoyed.

The Balance of Trade in Engineering

For the past fifteen years engineers on both sides of the water have been busily engaged in working up the apparatus of electric lighting, traction and power transmission, and now that we are passing through a somewhat quiescent period in development, a period characterized rather by refinement of method and increase in the scale of engineering works than by striking novelty or brilliant invention, it is a good time to look over the field and estimate as nearly as may be the importance of the friendly services which have been rendered by engineers here to those abroad, or vice versa.

Following the progress of any one particular invention or method, one often finds a curious tendency for it to shift back and forth across the Atlantic through many hands and many diversities of fortune before it settles into a definite, accepted place in the world's engineering. So, if one were to attempt to draw up a balance-sheet of the trade in improvement and invention between America on the one hand and England and the Continent on the other, it would be puzzling, indeed, to adjust equitably the relative debits and credits of the case. Nothing more than a study of this kind shows the respective intellectual tendencies of engineers on the two sides of the ocean, and with them the moving spirits of the countries they represent. For example, take so familiar an object as the great direct-connected dynamo, with which the generating stations of the world are, broadly speaking, now equipped. Substantially, this practice of direct connection had, at least on a commercial scale, its origin in the "Edison Jumbo" dynamos—nearly twenty years ago the great steam-driven dynamos that were to revolutionize the world's practice.

These machines produced a tremendous sensation, and, moreover, some of them did sterling work for nearly a decade; but the example set so early and clearly produced a relatively small impression on the art in this country. Year after year went on, and station after station was equipped with high-speed, belt-driven apparatus. Meanwhile, very slowly, but with certain steps, the multipolar design worked its way into favor abroad, while much neglected on this side of the Atlantic. With the multipolar dynamo came slow speed, and with it, again, direct connection to the motive power.

When apparatus of this kind began to find favor abroad, none seized upon its advantages more promptly than the American engineers, and they immediately set to work to develop multipolar, direct-driven generators to a point hardly imaginable by those who introduced the practice. The result is that at the present time America leads the world in the building of colossal direct-connected gener-

ating sets, while the more conservative engineers abroad are still clinging to belt and rope-driven apparatus in many cases, where an American would unhesitatingly use direct connection.

This is only one of numerous examples of a similar kind. The induction motor, for instance, was invented on this side of the Atlantic, but in spite of its sensational character the invention made small progress in this country until its possibilities had been demonstrated abroad at the Frankfort Exposition of 1891. Immediately the Americans jumped to the front in the development of polyphase apparatus, and have pushed forward the art of power transmission until there are more plants running in some of our States than in whole countries of Europe. The development of this branch of the art has been, in fact, the feature of the last decade, and the American engineers have been ahead, and kept ahead, most of the time. Even the rotary converter, which has now taken such an important place in street railway practice, has passed through similar vicissitudes. Invented in our own country by Bradley, it was brought into prominence, far less, however, than it deserves, by the Frankfort Exposition of 1891. To tell the truth, it was at that time and place so overshadowed by the Lauffen-Frankfort transmission that its real importance was dwarfed. It is probably safe to say that if that sensational feat of power transmission had not been performed the rotary converter would have been the most striking exhibit at Frankfort. The cue, however, was promptly taken by the American engineers, urged on by the impending installation of the great works at Niagara, and since that time the rotary converter has come rapidly to the front to see itself as part, and an important part, of the material of railway engineering. We Americans have been most zealous in its adoption—perhaps even too zealous sometimes—but, as in the other instances named, it has crossed and recrossed the ocean. Possibly, as in the case of whisky and cotton-seed oil, the sea voyage may have been assumed to do it good.

Sometimes, however, the initiation and development of engineering methods abroad have not met a prompt response here, and only slowly and even grudgingly have other improvements been recognized, whether the original invention was American or foreign. A fine type of this phase of the case is found in the slotted conduit electric road, which found its practical initiation in the United States from the pioneering skill of Bentley and Knight, very early in the art of electric traction.

The rise of the overhead trolley, which offered a cheaper means of attaining the same end, put the conduit out of sight; for Americans were not yet ready to go to the necessary expense to make it successful. Taken up abroad and developed as a practical working method at Buda-Pest and elsewhere, it was very slow in coming home again, and American engineers and tramway managers were only driven to its use by the iron hand of necessity. When once, however, they took up the problem seriously success was very quickly attained, and the development along this line has since been brilliant and widespread.

In similar fashion, the use of polyphase motors for traction purpose, although early suggested in this country, came to nothing; while abroad it has been taken up and has become one of the recognized methods for operating railways of the interurban or long-distance types. What its future fate in the growth of the art will be it is hard to say, yet it would not be surprising to see the history of other developments repeat itself and the polyphase motor finding its way into considerable, if by no means general, use here.

The grooved rail for urban traction is another excellent example of tramway practice brought into great prominence abroad before being adopted to any considerable extent in this country. American engineers have not liked it, nor do they like it to-day, yet it is forcing its way into widespread use.

It would be possible to go on citing instances of apparatus shifting back and forth across the ocean to a far greater extent than we have here attempted, but the examples already described are sufficient to show the general and important character of this form of international trade. It, perhaps, is not safe to generalize in such a manner, but it would look a little as though the good American motto of "nothing succeeds like success" finds another application in this instance.

American engineers have always been daring in invention, but unless large returns are not only in sight, but within grasp, the inventions are very slow to be adopted. Possibly the key to the situation may be found in the fact that until very recently the average return on investments in this country has been assumed to be conspicuously greater than abroad. Here we have for years expected at least 5 per cent or 6 per cent, where in England and on the Continent, 3 per cent or 4 per cent has been relatively as good a return upon the investment. Consequently, methods looked on as dubious here from the standpoint of financial return, might easily there be judged as likely to lead to fairly economical results. Whether this be the cause of the phenomenon or not it is certain that it has often been necessary for apparatus and methods to be reduced to working success abroad before they have found acceptance here, even when they were American in their origin. American practice has systematically pounded away at methods not always the best possible, but known to be profitable from the American standpoint. The result has been that the growth of engineering works in this country has been concentrated for a considerable period along a certain line of progress, and has only been deflected therefrom by necessity or by the certainty that some other line would yield equal or better returns. Abroad, while usually sluggish in taking up radical departures, it has been possible for engineers to adopt methods from which the Americans have turned in the hope of greater profit elsewhere. Eventually all these questions are determined on their strict merits.

Nothing shows better than this growth of the art back and forth across the ocean, the intuitive quickness of the American spirit in grasping opportunities for great and rapid profit, and the cautious conservatism abroad in selecting methods practically adaptable to their environment—even when the prospect of immediate return was less.

American energy and fertility of invention has produced a pronounced effect on the growth of all the electrical arts, but perhaps the comparative slowness and caution of the foreign engineers has, on the whole, exercised a salutary influence in steadying and rendering more symmetrical the rapid progress of American engineering.

J. A. RIGG

H. H. VREELAND

N. S. HILL, JR.

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THE COMING CONVENTIONS AT KANSAS CITY

KANSAS CITY AS A CONVENTION CITY

The American Street Railway Association has turned westward for the second time in two years for the place of holding its annual convention, and in Kansas City will be nearer the Pacific Coast than at any time of its previous meetings. While some of the street railway companies belonging to the association, who are located in the far East, may think that the West has been unduly favored in the selection for two successive years for a gathering place, they will find much to interest and instruct them in the city selected for the October convention. Historically, the city has played an important part in the electric railway industry. Partly from topographical reasons, which made the employment of mechanical power on its system important, the city was one of the first, east of the Rocky Mountains, to introduce cable traction. It is an interesting fact that many of these cable lines are still in operation in spite of the progress made in electric methods of propulsion. Again, in 1886, the city was the site of the early electric railway experiments by Henry, and boasts the great distinction of being the first city in the world in which the overhead trolley was successfully applied to commercial work. In the later improvements in the science of electric railroading, the city has kept abreast with the times, and under the able management of the Holmes Brothers, the Metropolitan Street Railway Company, the principal company in the city, has been brought to a high state of perfection. Although extensive alterations in power generation and distribution are being considered, the company's existing station is equipped with the latest large 1600-kw generators, and, as described elsewhere, shows an economy of operation and low cost of power production, which is perhaps not rivaled by any other railway power station in the country, using steam engines.

The topographical features of the city, while inducing street railway traffic, have also thrown upon the street railway company expensive engineering work, and the way in which the different problems relating to high climbing and in overcoming grades have been solved will prove of interest to those who operate street railways in cities similarly situated. The company has also made advances in track construction, introducing a number of new ideas, particularly in the use of concrete for supporting the rails. Some of the most important of these features of track construction were described by Mr. Butts at the Chicago convention last year, and other details of the company's practice in Kansas City are described fully elsewhere. The park question has also been carefully considered, and some of the most attractive parks in the city are owned and controlled by the traction companies. Outside of the city the principal interurban line is to Leavenworth, Kan. This is a modern high-speed road, and an excellent example of the many of its type which are being gradually introduced in all sections of the country.

Summing up, the American Street Railway Association made no mistake in selecting Kansas City as its meeting place for 1900. The list of papers prepared by the secretaries of the Street Railway and Accountants' Associations are on important subjects, which will be treated by well known authorities, and the convention promises to be the best yet held by the association.

AMERICAN STREET RAILWAY ASSOCIATION

The papers to be read at the nineteenth annual convention of the American Street Railway Association have been announced by the secretary as follows:

"Consolidation of Street Railways and Its Effect upon the Public," by Daniel B. Holmes, counsel, Metropolitan Street Railway Company, Kansas City, Mo.

"A Comparison of the Various Systems of Electrical Distribution for Street Railways," by C. F. Bancroft, electrical engineer, Massachusetts Electric Companies, Boston, Mass.

"Painting, Repainting and Maintenance of Car Bodies," by F. T. C. Brydges, superintendent of car shops, Chicago Union Traction Company.

"The Store Room and Store-Room Accounts," by N. S. Hill, Jr., general manager, Charleston Consolidated Railway, Gas & Electric Company, Charleston, S. C.

"Double-Truck Cars: How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions," by N. H. Heft, president, Meriden Street Railway Company, Meriden, Conn.

Regular sessions of the association will be held on Oct. 16-18. Friday, Oct. 19, has been set apart as a day for the examination of the exhibits. No session of the association will be held on that date, so that all may have plenty of time to view the exhibits. It is earnestly requested that managers have their heads of departments present on that day. The annual banquet will be held at the Coates House, Friday evening, when the officers elect will be installed.

The headquarters of the association will be at the Midland Hotel.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA

The programme of the convention at Kansas City of the Street Railway Accountants' Association of America shows that a most interesting meeting may be expected. In addition to the papers and reports to be presented a very important addition has been made to the collection of blanks; thus the interest aroused at Chicago will be continued this year. An examination of this exhibit gives an understanding of the part taken by blanks and forms in the construction and operation of the properties, an understanding necessary to the successful financial, operating or accounting officer.

As required by the by-laws, formal notice has been given that a change is proposed in Article VII. of the by-laws. This change will undoubtedly be the subject of earnest discussion.

Following the plan of the third annual convention, the programme provides for three half-day sessions, allowing the whole fourth day for examination of the exhibits. This

includes the exhibition of blanks, which will be open the whole day. The value of this exhibit has been greatly enhanced during the past year by the addition of the blanks and forms of new member companies, as well as of other companies which have not exhibited before. In addition to the regular forms used in accounting Secretary Brockway has been assiduous in collecting, during the past year, samples of rubber stamp impressions used in street railway work. In this connection he requests the assistance and co-operation of those companies who have not contributed to this collection. The stamp exhibit will be in a separate book from the present files, and the impressions will be in general on separate sheets, about 4 ins. x 6 ins.

The programme, in detail, is given below:

MONDAY, OCT. 15, 1900

7:30 p. m. Meeting of the executive committee at the Midland Hotel.

TUESDAY, OCT. 16, 1900

10 a. m. At the convention hall.
Address of Welcome.
Annual Address of the President.
Annual Report of the Executive Committee.
Annual Report of the Secretary and Treasurer.
Regular business routine.
Paper: What does the General Manager want to know from the Accounting Department? By John I. Beggs, general manager, Milwaukee Electric Railway & Light Company, Milwaukee, Wis.
Report of Standing Committee: On a Standard System of Street Railway Accounting. Chairman C. N. Duffy, auditor Chicago City Railway Company, Chicago, Ill.

WEDNESDAY, OCT. 17, 1900

10 a. m. Convention Hall.
Paper: The Routine of a Street Railway, Electric and Gas Lighting Company. By C. O. Simpson, auditor Augusta Railway & Electric Company, Augusta, Ga.
Report of Committee: Is a Standard Unit of Comparison Practicable? Chairman H. C. Mackay, comptroller Milwaukee Electric Railway & Light Company, Milwaukee, Wis.
Paper: Departmental Accounts. By H. L. Wilson, auditor Boston Elevated Railway Company, Boston, Mass.

EXTERIOR OF CONVENTION HALL, KANSAS CITY

THURSDAY, OCT. 18, 1900

10 a. m. Convention Hall.
Paper: Material and Supply Accounts. By W. M. Barnaby, accountant Brooklyn Rapid Transit Company, Brooklyn, N. Y.
Informal Discussion upon any subject in Street Railway Accounting. (This is to be in every sense informal.)
Reports of Convention Committees.
Election and Installation of Officers.
Adjournment.

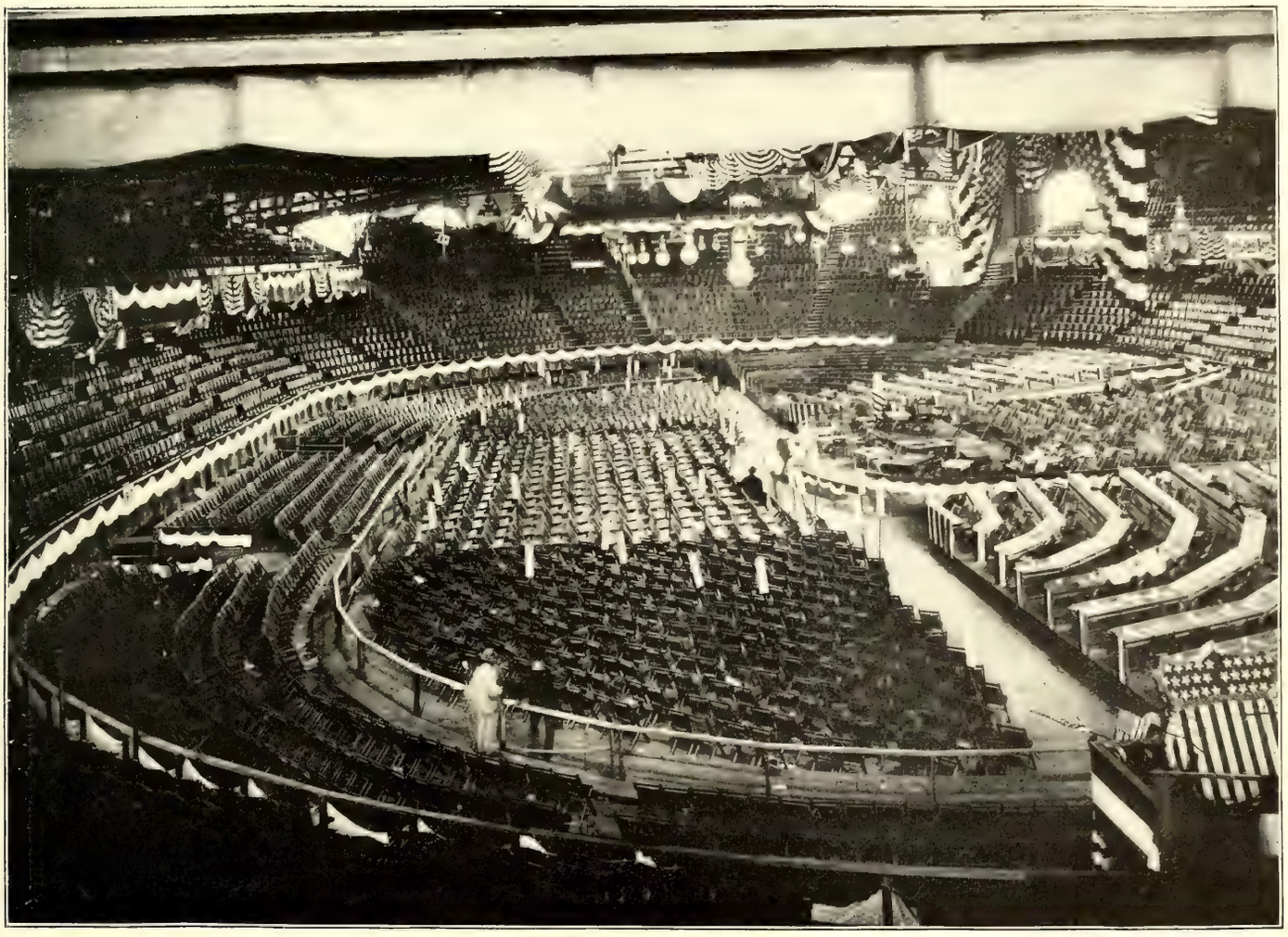
THE EXHIBITS

The exhibits, as announced, will be shown at Convention Hall, which is one of the largest open halls in the

country, and is admirably adapted for this purpose. It was erected this spring to replace an older hall on the same site, which was destroyed by fire, and is easily accessible from the principal hotels in the city.

The applications for space from companies intending to exhibit have been unusually large, and at the time of going to press practically all the space available had been taken. A general plan of the convention hall was published in the STREET RAILWAY JOURNAL for Sept. 8, with the assignments of space which had been made up to that time. The headquarters of the STREET RAILWAY JOURNAL will be found close to the entrance, on the left-hand side, and all visitors will be cordially welcomed.

Two views of the Convention Hall are shown in the accompanying engravings, one of which is of the exterior, the other of the interior. In the latter the arena is filled with seats, as the photograph was taken just before the hall was used for a national political convention last July. Of course during the street railway convention these chairs will be removed for the accommodation of the exhibits.



INTERIOR OF CONVENTION HALL, KANSAS CITY

TRANSPORTATION TO KANSAS CITY

A special rate of a fare and a third will be granted, as usual, to attendants at the convention. Persons purchasing tickets will pay full fare going to Kansas City, and should ask the ticket agent for a certificate, which, when properly countersigned at Kansas City, will entitle the holder to a return ticket at one-third fare.

Any of the principal lines from Chicago to Kansas City including the Burlington, Alton, Santa Fe Route and Rock Island will be found convenient from that city. From New York and the East the transportation committee appointed at the last convention has made arrangements for special accommodations over the New York Central Railroad, the Big Four and Wabash Railroads. These companies will run a special train, leaving New York about 10 o'clock Sunday morning, and reaching Kansas City Monday evening. A representative of the New York Central Railroad will accompany the party to Kansas City. The train from Boston leaves that city at 10:45 Sunday morning, and is due to reach Kansas City at 7 a. m. Tuesday.

A full statement in regard to the several trains running to Kansas City will be found elsewhere in this issue.

THE ENTERTAINMENTS

A full programme of the entertainments to be provided for the delegates and the other attendants at the two conventions has not yet been published. There are many interesting points to the visitor, however, in the neighborhood of Kansas City, and the local committee has intimated that this feature of the convention will be well cared for. Of course the principal feature of the social side of the convention is the annual banquet. This will be held at the Coates House on the evening of Friday, Oct. 19, when the officers elect will be installed.

CARS AND CAR SERVICE IN METROPOLITAN NEW YORK

BY H. H. VREELAND

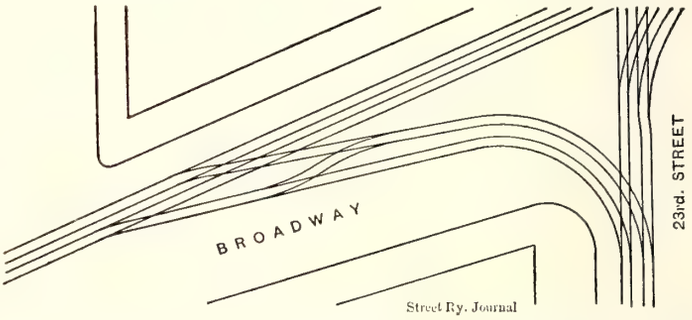
When I first came to New York in 1893 I assumed charge of a horse railway system comprising 123 miles of track, the backbone of which was the Broadway line, running from the Battery to Fifty-Ninth Street. On this Broadway line an unusually fast horse car service, with 16-ft. cars, was being given, while on the rest of the system 12-ft., 14-ft. and a few 16-ft. cars were run on comparatively slow schedules. The upper part of the city above Fifty-Ninth Street seemed like a country town, with horse cars dragging lazily along at intervals of from fifteen to thirty minutes.

I found the Broadway cable system nearly ready for operation. The first cable cars were 22 ft. in body length, and 30 ft. 6 ins. over all. The width at the windows was limited to 7 ft., on account of the small distance between the two tracks on Broadway, and the danger of crushing wayfarers between the cars. The cars were mounted on four-wheel trucks, were equipped with the Millen safety brake, and were protected by heavy bumpers. They had a (crowded) seating capacity of thirty-two passengers, and entrance and exit were made as easy as possible by ample platforms, low steps and double sliding-doors. The window space was also large, Pintsch gas was adopted for lighting, and, altogether, the first Broadway cars had a bright, clean, elegant appearance, which made them the most popular in the city.

Enough of these cars had been purchased by the former management of the Broadway system to provide for a one-minute schedule on that line, but it quickly became evident not only that such a schedule could not possibly serve half the people who wanted to ride, but also that interest could not be paid upon the enormous cost of the original line and its cable equipment. Orders were quickly placed, therefore, for additional cars, aggregating several times the original order, the load on the cable lines and station was so divided as to carry this larger number of cars, a sufficient force of inspectors was distributed along the line to properly pass the cars over crossings and through terminals, patrol wagons were placed within easy reach of the different parts of the line, so as to help in breaking up blockades —and cars have been running on Broadway at ten to fifteen second intervals for many years past.

The Columbus and Lexington Avenues extensions of the Broadway cable system involved no special traffic difficulties except at Twenty-Third Street and Broadway, where Lexington Avenue cars running at twenty-second intervals have to be thrown in between the Broadway main line and Columbus Avenue cars, passing, often, at fifteen-second intervals. This is quite a pretty little problem in switching, and it was feared at first that it would give us some trouble, but a way was found to do this work satisfactorily by means of what may be called "auxiliary waiting tracks," which meet and depart from the Broadway line on curves of such large radius as to expedite the car movement, and reduce delays to a minimum. Fortunately Broadway broadens at this point, so that this can be done.

Switchbacks at various points on the Broadway, Columbus Avenue and Lexington Avenue lines have been established so as to serve the different classes of travel, and it has been for some years impossible to materially increase the very large number of moving cars along the main Broadway stem from Fifty-Ninth Street to the Battery. The average time interval between cars on any line is, of course, determined by the number of cars which can pass through its most congested crossing or terminal—not by the average number which can be distributed along the entire line. The limit of the car movement on Broadway is fixed by the Twenty-Third Street crossing, not by the south Battery terminal, as many may suppose, for the number of cars which reach the latter point are by no means the entire number on the line, but are comparatively few, and can easily pass around the Battery Park loop or



PLAN OF TRACKS AT BROADWAY AND TWENTY-THIRD STREET

through the South Ferry stub terminal. At Twenty-Third Street and Broadway, however, a line of north-bound and south-bound cars, each crossing at ten-second intervals, meets a line of east-bound and west-bound cars, each crossing at fifteen-second intervals, and 200 ft. away comes another heavy switching point for the Lexington Avenue cars. The only way in which crossing work of this kind can be done is shown herewith. A Twenty-Third Street east-bound car almost touches the rear platform of a Broadway south-bound car as the former enters and the latter escapes from the crossing. It is evident that such crossings are made possible only by the most carefully trained force of inspectors, and I may as well here express my belief, in a somewhat emphatic way, that the secret of properly moving cars through congested districts is found in an ample force of inspectors, trained to save every second, and take advantage of every opening.

The beginnings of our electric system were, as is well known, made on Lenox Avenue, north of Central Park, and it was here that the experiments were made which led us to decide to equip a large part of our system with a motive power which is, on the whole, vastly superior to the cable system, both in capacity for handling traffic and in economy of operation. In place of the slow-moving, infrequent and wholly uneconomical horse cars, we have put upon several of our main north and south lines and a few

of the crosstown lines a clean, rapid, frequent and largely patronized electric service, which has probably done more to build up the city north of Fifty-Ninth Street than any other one influence of the last ten years. Three years ago horse cars made the round trip from Madison Avenue and 138th Street to City Hall and return in about three hours, and less than 200 cars were needed to handle the 17,000,000 passengers who offered themselves for the journey. To-day the round trip is made in less than two hours by the electric cars, and some 300 cars, each nearly double the passenger capacity of the old horse cars, are required to carry nearly 50,000,000 passengers, who patronize this route. I do not know much about the public of other cities, but I do know that the New York City public responds instantly to every improvement in traffic offered, by the heavy trucking along New York streets, by the narrowness of many of these streets, by the sharp curves which are in many places unavoidable, and by the elevated railroad pillars, which are oftentimes badly placed with reference to these curves. Even where there are few difficulties of this kind in the large north and south lines, there is sometimes a limit to the width and length of the cars by the narrowness of a few cross streets, as by Fifty-Ninth Street, for example, through which the Sixth Avenue cars must pass to reach Amsterdam Avenue. To show how closely we have to consider every little detail in the matter of car widths, etc., I would say that we are unable to use straight sided cars in New York because the 2 ins. gained by "cutting under" the lower panel means the difference between passing through a street crowded with trucks or

VIEW AT CORNER OF BROADWAY AND TWENTY-THIRD STREET, SHOWING CONGESTION OF CAR TRAFFIC AT THAT POINT

and the balance of popularity between the elevated and surface lines or between parallel surface lines is so delicately adjusted that a single improvement in one or the other often means a change in the daily riding habits of thousands upon thousands of residents.

When we first started on our electric railway experiments, we used the same type of car as had proved popular on Broadway, namely, the 22-ft. body, with a single (extension) truck. We soon found, however, that the increase of travel along our electric lines was so rapid that the limit of car and passenger movement would be too quickly reached, and we therefore determined to adopt long, double-truck cars, both open and closed. These have a greatly increased passenger capacity, but can be passed through the most congested "neck" of the system practically as rapidly as the smaller cars, thus adding about 40 per cent to the passenger carrying capacity of our lines without increasing the car unit capacity. By these cars also we can, of course, reduce the transportation cost of conductors' and motormen's wages per passenger carried. A limit to the building of these long cars is, however, set getting blockaded every 100 ft. The outer hubs of trucks standing close to the curb in many of the streets, particularly in the lower part of the city, would strike a square sided car and prevent its passage.

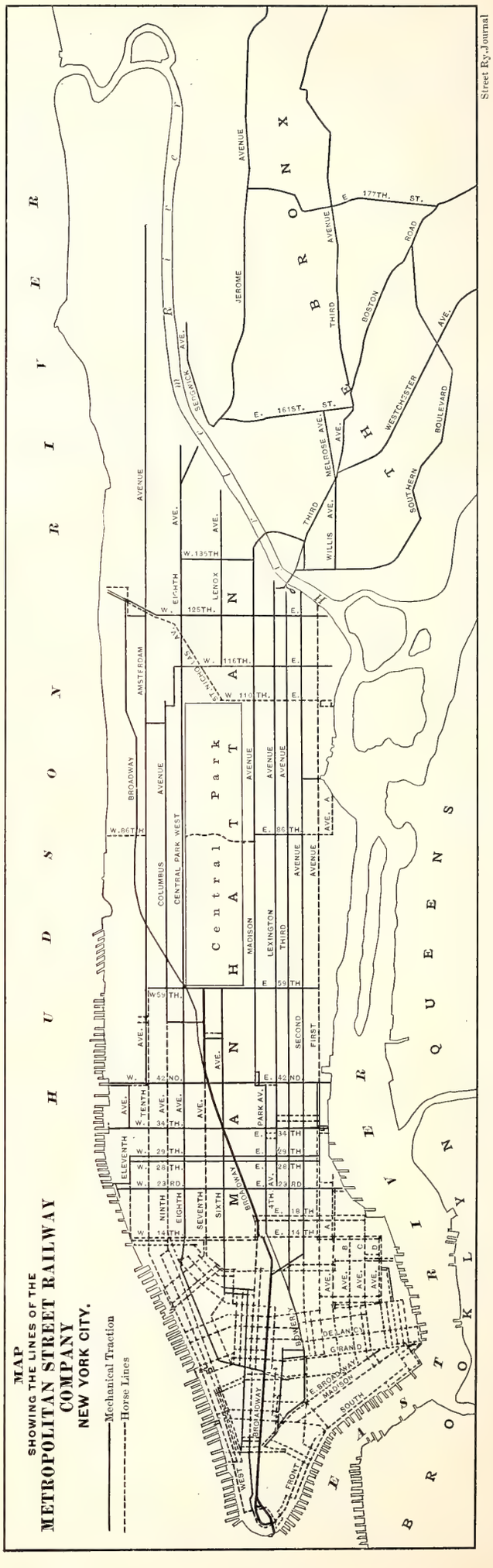
The car finally selected as our standard electric car has a 28-ft. body, mounted on double pivoted trucks, and gives us an increased carrying capacity of about 40 per cent, with but very slight advance in the cost of car service, motive power and maintenance. The pivotal trucks take the curves well, and save a good deal in wear and tear of roadbed, while the body of the car is only an inch higher than that of the four-wheel car. Large as they are, these cars start quickly owing to the increased tractive force in the motors, made possible by the disposition of greater weight on the driving wheels, and they are easily controlled by hand brakes similar to those used on cable cars. In general appearance and in exterior and interior finish these cars are merely larger editions of the 22-ft. single-truck cars originally described.

For several years after the establishment of a cable service on Broadway, closed cars only were used, as it was then

believed impossible to pass open cars through so crowded a street without too great danger of injury to passengers. The traffic on Broadway was, of course, very heavy in the morning and late afternoon, and was almost equally heavy in the middle of the day, because of the vast amount of short distance riding to and fro on this street both for shopping and business purposes. After the uptown movement at night was finished, however, there were four or five hours yet left of the evening, and the traffic during these hours, particularly on lower Broadway, was small and unsatisfactory. I determined to cultivate traffic at these hours by putting on open cars, and I privately determined, also, to quietly extend the open car service experimentally into the other hours of the day to see whether the fears which were entertained were or were not justified. As a result of these experiments the evening traffic immediately increased very largely, and has since been uniformly satisfactory in the spring, summer and fall months, while there have really been quite as few accidents on the open cars traveling in daylight as on the closed cars. The New York public is sensible, and knows how to take care of itself, and has always recognized the wisdom of the rigid rule which we adopted from the start of allowing no one to stand on the footboards of open cars. The side bars used on the inner side of the car, in connection with our rule that the conductors must turn up the footboards on that side to a vertical position before starting on their trip, has been completely effective in preventing accidents on that side of the car. The open car service in New York City is as firmly established and as successful from every point of view as it is in any country village of the land.

Not long after open cars came into use with us, the city health board made a rule that a certain percentage of our cars must be closed—thus quite properly providing for invalids or others who could not stand the breezes of the open car. This rule finally led us to decide upon a plan which had been in our minds before, namely, to experiment with the "California type" of combination open and closed cars. Twenty of these cars (illustrated in the following article) were ordered, and while complying, as they did, with the requirements of the board of health, they also gave such general satisfaction to the public that the number has since been largely increased, and further purchases are steadily being made. The closed compartment seats sixteen people, and the open part thirty-five. Smoking can be indulged in in the open section, and this feature of the cars has been so popular that in response to what was practically an imperative public demand, these combination cars were run almost through the entire winter of 1899-1900. To the man who is well bundled up for winter travel in the comparatively mild climate of New York, a ride in the open section of such a car is a pleasure in itself, particularly when he has in addition the privilege of a quiet smoke.

I have said that the car capacity on the Broadway cable line was practically up to its limit. The passenger capacity also is nearly there so long as the road remains a cable line. By the adoption of electricity, however, with all that this means in increase of size of cars, increase in speed, ability to make up lost time, better handling of cars on crossings, etc., the passenger traffic at least will be materially increased, sufficiently so, we think, to earn a good return upon the cost of conversion, apart from the many ad-



vantages of having the entire system run by one motive power. We shall use on this line the double-truck open car, the double-truck closed car, and the double-truck combination car, such as are now used on our other electric lines.

The Metropolitan Street Railway Company has sometimes, I believe, been criticised for what is thought to be its reckless waste of money. "Why should you have two fenders on your cars?" many a manager has asked me. "I have only one, and my conductors and motormen change that to the other end of the car on the return trip." "What is the good of that mechanism for raising the footboard," another manager asks. "If you want to raise it, why don't you have your conductor and motorman do it." My answer to these questions is: "My dear sir, every second of time saved at terminals has an immense value in the operation of cars on a ten-second interval. If I should make my conductor and motorman lift off a fender from one end, carry it to the other end and attach it there, and lift up the step, it would take at least a minute, and my ten-second schedule would be thrown to the winds. Every device which we can put on a car to save time, no matter at what cost, is true economy from every point of view —it sends more cars down the line, the public has better service, and gross receipts are increased by a sum far greater than any picayune saving in interest on the cost of that device."

A few words about transfers and their influence upon gross and net earnings may not be out of place. Manhattan Island is long and narrow, and the trend of traffic is down in the morning and up at night. The cross streets are short. New Yorkers are busy people, and usually ride for a purpose. They do not care to make any more changes than necessary, and they will choose a through route rather than a transfer route, if they can find one fairly convenient at hand. The innumerable crossing points of the different lines on so large a system mean, of course, immense complexity in the scheme of transfers, and at first sight it would seem impossible to prevent large loss of revenue from the adoption of a general transfer system. We no doubt do lose many million fares each year that could otherwise be gotten, but we have proceeded on the broad ground that everything that will promote public comfort and convenience in this particular city will, in the long run, have a reflex action upon our own prosperity.

We have not, however, gone about this transfer business in a blind way. A force of inspectors is constantly studying traffic and traffic conditions, is finding out how people travel, and how they want to travel, is experimenting with new transfer routes, reducing congestion on this line and filling the cars on another, and in general is trying to so distribute the immense mass of the New York riding public which forces itself upon our cars as to give the greatest comfort and the best service to all.

VIEW OF LOWER BROADWAY

The methods which we adopt in New York, however, will probably not be suited to any other city in the world. They rise purely out of local conditions, and if applied elsewhere might quite as easily lead to bankruptcy as to prosperity. All we know is that for our own conditions we are satisfied with the results, despite the fact that our gross and net revenues might very possibly be larger were we not so generous with the public.

THE STANDARD CARS OF THE METROPOLITAN STREET RAILWAY COMPANY, OF NEW YORK

BY THOMAS MILLEN

Elsewhere in this issue Mr. Vreeland has discussed the general traffic conditions in New York City, so far as they have affected the types of cars employed by us, and has given the governing reasons which have led to the adoption by the Metropolitan Street Railway Company of its four types of standard cars. The purpose of this article is to describe in detail how the principles laid down in the paper referred to have been applied in practice to our car construction, and to give, as well, some of the practical kinks which we have developed from our experience in operating cars in New York.

STANDARD SINGLE-TRUCK CLOSED CAR, NEW YORK

A wrong idea of the practice employed in the construction and operation of cars in New York City will be derived, however, unless the reader bears constantly in mind the conditions under which we operate. Of these conditions the most important is undoubtedly that of economizing time, many other considerations being sacrificed to this end. The immense traffic carried on most of our lines, the consequent short headway necessary, together with the somewhat cramped terminal facilities of many of the divisions, all give the question of time an importance which would not obtain, perhaps, in many other places. Thus, we have been criticised for equipping each end of our electric cars with fenders. This would undoubtedly be an unnecessary expense if we could afford to hold our cars at the termini long enough to allow the conductor and motorman to transfer the fender from one end to the other, but under our own conditions the time saved by not making this transfer amply repays the additional first cost of the additional equipment. Working in the same direction, we have provided handles on our open cars for raising and lowering the running-boards. With this device the side steps can be raised or lowered from the platform by either the motorman or conductor, when the car is in motion. This might seem to some an unnecessary refinement, but to us it means the saving of several seconds by each car. In the first place, the steps can be changed at the end of a route without delay; again, they can be temporarily raised from either platform to pass a vehicle of any kind in a crowded or narrow street.

In fact, if a certain operation on the road requires a minute, the energies of the operating force are bent toward reducing that minute to fifty seconds; if it takes fifty seconds, we endeavor to bring the time to forty; and if forty, to thirty-five or thirty.

A second consideration, probably ranking next in importance after that mentioned, is durability. For this end we have made a study of the best wearing body color, the most serviceable lettering, the character of interior finish most easy to keep clean and in good condition, and other details of that character, and have adopted them as standard on our system so far as the different characters of cars used permitted of their employment. Some of the methods used by us in this department are more particularly mentioned in connection with the descriptions given below of the several types of cars in use.

A third consideration is that of simplicity. This sometimes has to be sacrificed to gain running time, as, for example, in the instances mentioned above, but where it has been possible, we have sought to avoid complexity of apparatus and elaboration in finish and decoration. To those who have been accustomed to ornate ceilings, lettering, colors and other rolling-stock decorations, our cars may appear severe, almost plain. Our interior finish is ash with

bird's-eye maple for the ceilings and panels; there is no colored glass in the deck-light; the seats in our closed cars are covered with Wilton carpet of tasteful design, not upholstered in plush or rattan; the main panels are painted in orange with lower concave in cream. We believe, however, that this simplicity gives a rich effect, which in the end is more satisfying than more pretentious decorations, besides being more durable. Certainly, so far as the effect is concerned, we have had no complaints from New Yorkers, who, as a rule, are pretty strict in their artistic tastes, while we have had many compliments from authorities in art, whose opinions in matters of this kind admit of no question.

Taking up now briefly the four standard types of cars in use, I will describe first the four-wheel closed cars.

The four-wheeled closed cars are 22 ft. long over the corner posts and 30 ft. over the dashers; width at sills, 6 ft.; width at belt-rail, 7 ft. They have eight windows on each side; the sash is glazed with Chance's English or an American glass, and fitted with Stephenson metal stiles, which gives a greater area of glass and makes the sash less noisy. The car has a full monitor deck roof, strengthened with five concealed steel rafters $\frac{5}{8}$ in. x 1 in., with eight movable ventilators on each side, glazed with white chipped imitation beveled-edge glass and two end transoms, which are stationary; this is done to prevent leakage in a driving storm. Double doors, with mutually operating mechanism, are used.

The open platforms at each end are 4 ft. long, with unusually strong channel steel gates; both right-hand side openings of platforms are used for loading and unloading. Each platform is held up by four platform knees or bearers made extra heavy and strong. It extends out beyond the crown pieces and takes a $3\frac{1}{2}$-in. x $7\frac{1}{2}$-in. angle iron, bent to circular shape to act as a bumper. This buffer not only assists in supporting the car body, but is a great saver of broken and bent dashers. Before our cars were furnished with buffers we had from ten to twelve dashers bent or broken every day, through collisions with trucks and other heavy vehicles. Our first buffers were of oak, with steel facing, but our new cars are now all being equipped with the angle buffer mentioned. Since the addition of these buffers it is a rare thing to have a bent or broken dasher. No radiating bar is used, but instead the platforms are equipped with a strong malleable iron draw-head having a large open mouth, which permits of a radiation of sufficient length necessary to haul a trailer around the shortest curves. The gates are hinged to the hood supports, and fold in toward the dashers. The inside and outside trimmings are of solid bronze. The dashers are made of No. 12 sheet steel, with the usual number of posts secured in the usual manner, but the dasher has the additional support of a strong angle iron at the bottom, which is fastened to the platform crown pieces and riveted to the dasher. There is a bracket fastened to the outside of the corner posts at diagonally opposite corners for a signal lamp. The cars are fitted with Sterling's safety brake, which multiplies the leverage and power, and with Sterling sand-boxes and registers.

STANDARD DOUBLE-TRUCK CLOSED CAR, NEW YORK

The inside finish of the cars, as stated, is pure white ash without specks or streaks, and the ceilings are of bird's-eye maple veneer. The latter is divided into panels by ash moldings; there is no decoration of any kind on the ceiling. The seats and backs are of three-ply veneer and paneled underneath with white ash, and covered with heavy Wilton carpet of rather an odd, but pleasing, design. Some of the older closed cars are fitted with Venetian blinds, but the greater number of our cars have pantasote curtains. The floors are covered with Lewis' diamond mats, which are not very largely used and not generally liked by railway men; as a rule, they prefer the wood strips fastened to the floor.

Owing to the length of these cars and the difficulty of keeping up the ends incident to the tremendous overhang, the cars are fitted with $\frac{1}{2}$-in. x 5-in. plates placed on the inside of the sills, with a foot turned on them taking the end sill, and there is also a high inside truss on the truck, so that the ends are amply supported and capable of carrying the heaviest loads without deflection. The cable cars are fitted with Gold hot-water heaters and the electric cars are fitted with Consolidated electric heaters and electric headlights.

The lighting is the Pintsch gas system on the cable cars, and electric lights on the electric cars. There are four

Millen revolving signs to each car, one on either side and one on each hood operated inside of car. On the electric cars an innovation has been introduced in the lighting of the signs at night by an electric light and a hood reflector.

The cars at the present time are not so elaborately painted as formerly; there is no scroll-work, the striping being plain and the lettering of plain block letters. The color of the center panel is of a deep orange, which is a strong and lasting color, and the color of the convex, or sunk, panel, and between the windows and dasher, is a light cream, which we think makes a good combination. The sash-rails on the later cars, instead of being varnished, are now painted and varnished, which we think is an improvement, so far as economy and durability is concerned, over the plain varnish, which was formerly the practice. The cars are bound at the corners with heavy iron bands, and are bolted to the rails and corner posts, making strong and stiff corners; there are also corner brackets at the corner posts onto the sills.

The standard truck used on the single-truck cars is the "Metropolitan special," made by the Peckham Truck Company, and on the electric lines these cars are equipped with two G. E.-1000 motors.

The standard double-truck closed electric cars are 28 ft. over the end panels and 36 ft. over the dashers. They have a width of 6 ft. 6 ins. over the sill, and 7 ft. 6 ins. over the belt-rail, being 6 ins. wider at both points than the four-wheeled cars. There are ten windows on either side and ten ventilators. The standard of finish, bumpers, trimmings, sash, seats and backs and everything as far as practicable is the same as the four-wheeled cars, excepting the dimensions, as stated above. Of course, the body framing in these cars is different from the four-wheeled cars, so as to enable the use of pivotal trucks of the Brill Eureka maximum traction type. As the supporting points in these trucks are not as far apart as on most cars, for reasons mentioned later, an additional support to the body is given in the shape of a truss-plank 2½ ins. x 12 ins., gained about each post and fastened to the corner post end with a cambre, so as to support the ends and the center at the same time; this plank is in addition to the high truss-rod, which is fastened to the post, and the straining-rod. The interior of the car is lighted with three three-light clusters of lights and heated with Consolidated car heaters.

The Brill maximum traction trucks are fitted with 30-in. driving wheels and 20-in. trail wheels. They carry the motor between the wheels, and the weight of the body is carried on the side and pivot rub-plates. There is an automatic device in the truck, so as to throw more weight on the little wheel when going around curves. The advantage of this form of truck over other forms is that the motor is on the inside and not on the outside, which enables us to use a stronger platform with longer knees and more of them. Trucks of the pivotal type with the motor on the outside in radiating interfere with the platform timbers, and in consequence it is difficult to keep them in alignment. These trucks are also fitted with the Sterling brakes, the same as the four-wheeled cars. Owing to the necessity of having a narrow car, because of the narrow streets, the use of any other truck than a truck of the type adopted was out of the question, it being necessary to keep the cars down low, and with this type of truck we have practically the same rise from the ground to the step and from the step to the platform, as an ordinary four-wheeled car.

STANDARD DOUBLE-TRUCK OPEN CAR, NEW YORK

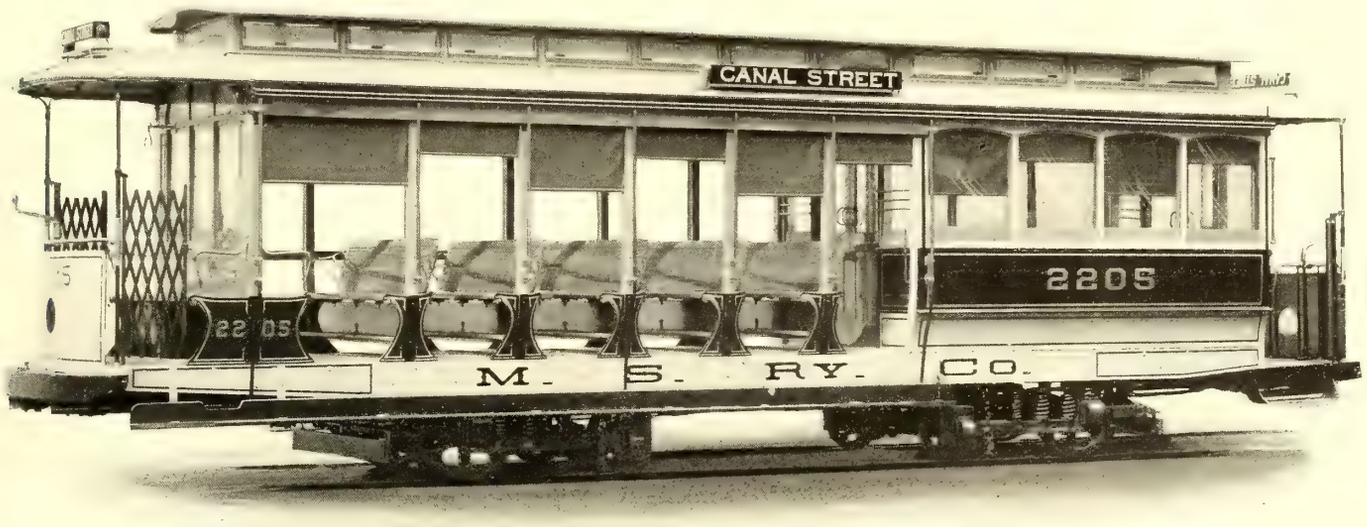
The double-truck open cars have a length over the dashers of 35 ft. 11 ins.; width at posts over seats, 7 ft. 2½ ins.; width at sills, 6 ft. 5 ins., making twelve seats in all. There are three end sash arranged to lower between the backs of the end seats. The seats and backs are of cherry and ash slats properly spaced, the backs being framed and pivoted by arms or levers pivoted to the posts. The seat-end panels are of the malleable iron type, with Brill's patented round corners and curtain guides, so as to allow the curtains to come to the top of the sill, thereby closing the whole of the opening. The roof is of the monitor-deck pattern, and is strengthened by six concealed iron rafters. On the water-table on either side there is a drip, or rain-gutter, so as to catch the dripping of the rain from the roof, arranged at both ends with outlets through the grab-handle to a point below the step, and also two similar spouts between the ends making four on either side. The steps, as stated, are arranged to hinge, and are kept under control by the motorman or conductor from the platform of the car. The entrance guard is of the Brill type, and when not in use is

pushed up under the water-table and held in place by gravity catches. In the first lot of cars made for the Metropolitan Street Railway Company the sill-plates were $\frac{5}{8}$ in. x 7 ins., but in the later cars we have had them made $\frac{3}{4}$ in. x 10 ins., which allows a projection down beyond the sill of the car by 3 ins. The necessity of this plate was caused by the fact that we were obliged to make the centers between the trucks 10 ft. from each end, because of the transfer tables in the several car houses. This tremendous overhang we found extremely difficult to take care of, and in consequence we were obliged to use this enormously heavy and unusual-sized plate. I am pleased to say that the cars have stood up wonderfully well. The corners of each step are protected by an angle iron bent to shape and properly bolted to the step.

The combination open and closed cars of the "California" type have a length of 36 ft. $\frac{1}{8}$ in. over the dashers.

All of our recent cars have been supplied by the J. G. Brill Company, which is also the manufacturer of all the double (maximum traction) trucks used on the system.

The lettering on the cars is a subject to which we have given a great deal of attention, the objects in mind being to secure a neat and tasteful design, which would be at the same time economical to put on and maintain, and would at the same time be legible by day and night. For our signs we have tried white letters on a black ground, black letters on a white ground, and a large variety of color combinations, and have finally settled on the first named as giving the best results. All striping on the main panel is in aluminum, and all figures on the dash and lettering on the sunk panel is in Indian or tuscan red. The form of letters employed is shown herewith, which is a reproduction, exactly one-sixteenth the size of the first three letters of the company's name as it appears on the sunk panel.



STANDARD COMBINATION CAR, NEW YORK

They are 6 ft. 5 ins. wide over the sills, and 7 ft. $2\frac{1}{2}$ ins. wide over the posts. The sills are $4\frac{1}{2}$ ins. x 7 ins., and the plates are $\frac{3}{4}$ in. x 10 ins., tapering at each end. The closed compartment has four windows having a length of 11 ft. $4\frac{3}{8}$ ins., and has double doors at either end, the general style and finish being the same as the ordinary closed cars. The open compartment has five reversible seats and two double seats, and generally comports in finish to the standard open car. It has an entrance guard, rain-gutter and gates. The folding steps on this type of car are somewhat different from the first lot employed. They had the folding steps made the whole length of the car body, and the sills running from end to end. In practice, we found it necessary to have a low platform for old and decrepit people, and the side step was cut off just at the junction of the closed and open ends and an ordinary step similar to that on closed cars was fastened to the platform. This is the way in which one hundred cars of this type are finished, and we consider it a considerable improvement.

The air cars which we have in operation on the Twenty-Eighth and Twenty-Ninth Street lines are generally the same as the 22-ft. single-truck cars, with the exception that they have a little greater width at sills to allow for the bottles, or air reservoirs, under the seats, and the framing is somewhat different for the air machinery.

We use on both the single and double-truck cars a standard 30-in. wheel, with $\frac{3}{4}$-in. flange and 2-in. tread. They are made by the Rochester and New York Car Wheel Works, and weigh from 300 lbs. to 325 lbs. each. The maximum traction truck trail wheels, as stated, are 20 ins. in diameter. Our brake-shoes are of the Lappin and Diamond types, and on the single trucks we use a special gravity brake-shoe hanger, which dispenses with the usual spring.

During the summer all closed cars are thoroughly overhauled and put into shape for the winter service, while the winter is spent in our repair shops in renovating our open cars. We do not find that six months is any too long for

STANDARD LETTERING USED ON SUNK PANEL

putting one-half of our rolling stock in good condition, and have not had any trouble from the deterioration of cars in storage, of which some roads complain. Our overhauling is most thoroughly done. As a result of this thorough fitting up, the cars during their six months of service have no work put upon them outside of a daily cleaning, except in case of accident.

MODERN METHODS OF TRAMWAY FINANCE

BY WILLIAM J. CLARK

Financiering, like human nature, is much the same the world over; true, certain features incidental thereto are more conspicuous in one country than in another, like the differing characteristics of individuals. The great monetary centers of the world, however, are now in such close contact that no great differences in underlying financial principles do or can exist between them.

The general conditions are simple. About these centers there is capital; this in the possession of two different elements; the first consists of bankers, capitalists, financial institutions, syndicates, etc., who to a great extent may be considered temporary investors, although upon them generally rests the direct burden of carrying all large undertakings to a successful conclusion. Hence such element is entitled to liberal compensation for the risks which it assumes in so doing, and for successfully reaching that other element "the fickle public," which, in the strictest sense of the word, is the permanent investor. The latter class can only be reached through the former.

The essential features to permanent successful financiering are meritorious projects, and the proper presentation of the same in accordance with the local practice of the various monetary centers. The merits of some particular undertaking may occasionally carry it through, even though badly presented to the first mentioned element, but rarely, if ever, is the result successful when such a presentation is made to the second. Frequently the financiering of projects of little merit is successfully carried through by ingenious presentation to either class. These incidents, however, may scarcely be considered as affording a permanent plan for successful financiering.

The proper channels and correct methods for street railway financiering in America are so well known to the STREET RAILWAY JOURNAL's readers that no detailed description thereof is necessary.

Such variations in the details of financial practice as are found in different countries may be attributed more to the effect of local laws, precedent and tradition, than to any material difference in the ideas of financiers at London, New York, Paris, Berlin, Brussels or Antwerp, either as regards methods or the value of investments. This is illustrated by stating that it has not been timidity in European financial circles, nor suspicion of tramway investments, which has retarded the development of tramways in Europe itself, for the part which European capital has played in the development of American street railways disproves this.

As the street railways of the United States are operated by American companies, no records are available in Europe to show the exact amount of European capital invested therein, but, to the writer's personal knowledge, English capital to the extent of at least $35,000,000 is invested in American street railway securities, and it is reasonable to suppose that the total of such investments must be larger than that figure. French, German and Belgian capital to a considerable amount is similarly invested.

With few exceptions European capital has not been placed in American securities by direct subscription in the United States. It has bought American street railway bonds that have been underwritten by American financial institutions and syndicates. This condition of affairs, however, is now rapidly changing, owing to the great prosperity of America and a stringent money market in Europe, so that to-day it is not uncommon to hear of European projectors of tramways seriously contemplating the possibility of financiering their undertakings at New York. Up to the present, however, but a small amount of American capital has been invested in European tramways, although the financiering of two large Continental enterprises of this character has been successfully carried through by Americans aided by European funds. Though the commencement of American investment in foreign tramways began but recently, the progress has been rapid in countries other than those of Europe, so that to-day the total investment of American capital in tramways outside of the United States aggregates $25,000,000, or approximately the same sum as is similarly invested by Continental Europe.

With the exception of those properties in which they are, or intend to become, interested, Americans have not, however, acquainted themselves as thoroughly with important tramways abroad as have the Europeans, and the knowledge thereof which is possessed by the great financial institutions of Europe will surprise the American not familiar with the subject. In fact, it would be difficult to find one of these large financial institutions of Europe which did not possess more or less knowledge concerning the physical features and earning capacity of all the larger electric railway and tramway enterprises of the world, no matter where they are located. To illustrate this, some months since the writer had occasion to discuss a prominent American street railway with the officials of a large Continental bank, when, to his surprise, there were produced complete data upon the property, analyzed most carefully in every detail. On inquiry, the fact was revealed that in the files of the bank were similar data on practically every important street railway in existence. It is questioned if a similarly complete collection of such information on properties in the United States alone could be found in any American bank or trust company.

From the above it will be seen that the American promoter who is ambitious to float some street railway project in Europe need not expect that the financiers do not or will not know fully concerning his enterprise before they invest therein.

The European public has been, and is frequently, imposed upon in connection with companies whose securities are given out for general subscription, but the European financier is rarely placed in this position.

The extent of European investments in tramways, according to national boundaries, cannot be accurately traced, for with companies organized under the laws of countries abroad, in which certain European capital has been placed, such fact is not made apparent by available

records, nor with companies organized under the laws of certain countries of continental Europe is it always possible to tell in which country the capital, or more properly, certain proportions thereof, are invested.

In Great Britain accurate figures are obtainable, however, both as regards the capital invested in home undertakings and in companies organized under its laws to operate tramways elsewhere. This, of course, does not cover British investments in companies organized elsewhere, but comparison between the two first mentioned characters of investment is interesting, as may also be certain figures on the authorized and subscribed capital of the tramways in Great Britain itself, and on the expenditures of the same that have been made, together with their extent, equipment and results from operation:

TRAMWAYS IN GREAT BRITAIN. AUTHORIZED CAPITAL SHARES AND DEBENTURES, INCLUDING COMPANY AND MUNICIPAL UNDERTAKINGS

Year	Shares	Loans and Debentures	Total
1878	£4,557,149	£2,028,962	£6,586,111
1882	8,525,007	4,061,036	12,586,043
1896	12,590,453	5,050,035	17,640,488
1890	12,426,454	5,376,627	17,803,081
1894	11,121,632	6,621,403	17,743,035
1898	12,567,326	11,868,101	24,435,427
1899	13,024,762	13,572,630	26,597,392

PAID-UP CAPITAL AND DEBENTURES

Year	Shares	Loans and Debentures	Total
1878	£3,177,146	£918,318	£4,095,464
1882	5,950,693	2,478,610	8,429,303
1886	9,104,680	3,284,824	12,389,504
1890	9,582,165	3,919,861	13,502,026
1894	9,112,094	5,000,479	14,112,573
1898	8,313,760	7,606,644	15,920,404
1899	8,516,716	9,536,057	18,052,773

TOTAL CAPITAL EXPENDED

(Actual Investment in the Properties)

Year	
1878	£4,207,350
1882	8,261,815
1886	12,573,041
1890	13,735,769
1894	14,388,698
1898	16,492,869
1899	18,603,222

These actual expenditures up to 1899 were divided between municipal and company undertakings as follows:

In tramways belonging to municipalities	£8,134,530
In tramways owned by companies	10,468,692
Total	£18,603,222

This means, on a basis of 830 miles owned by municipalities and 834 miles by companies, an investment of approximately £9,800 per mile of single track for the tramways owned by the municipalities, and an investment of £12,552 per mile by the companies. In explanation of this feature it should perhaps be stated that up to June 30, 1899, when the official statistics, upon which these figures are based, were published, electric traction had been more generally adopted by the companies than by the municipalities.

Still digressing from the title of this article, a word will be said concerning the equipment and results from operation of British tramways. The official Parliamentary report for the fiscal year 1898-1899 gives the following:

Total number of horses	44,171
Total number of cars	6,323
Total number of locomotives (including motor cars)	584
Total number of passengers carried	924,820,247
Total number of car miles run	96,078,503
Gross receipts	£4,879,602
Gross receipts per car mile	1s. 0.192d.
Operating expenses	£3,675,559
Operating expenses per car mile	9.12d.
Net receipts	£1,204,043
Net receipts per car mile	3.072d.

On January 1, 1900, British companies organized to operate street railways abroad were authorized to issue the following securities:

Shares	£14,444,025
Debentures	4,099,492
Total	£18,543,517

On these the following sums have been paid in:

Shares	£9,854,372
Debentures	2,793,777
Total	£12,648,149

To ascertain the total amount of British investment in foreign street railway companies, it is necessary to add to the foregoing figures an estimate of £4,000,000 obtained from a well known banker for shares and debentures of Continental companies held in Great Britain, £2,000,000 invested in similar undertakings organized under the laws of the Colonies and of countries outside of the United States and Canada, and £6,770,000 for British capital known to be invested in the securities of American and Canadian street railway companies. This would make a total of £25,418,149, or, roughly, $127,000,000, as the total investment of British capital in ex-territorial tramway undertakings, or, say, $34,000,000 greater than the sum invested in the tramway undertakings in Great Britain itself. The latter class of investment, however, is now being rapidly increased through the introduction of electric traction and additions to trackage.

The investment of Continental capital in tramways is of much greater importance than that of Great Britain, but, as already intimated, it is impossible to locate such capital either in accordance with the countries of its origin or where it is expended, for, in addition to what has already been said on this feature, to a great extent the Continental financial circles which have made or placed these investments are organized on international lines—the bankers of Belgium, Germany, France, Holland, Austria and other countries frequently participating in a single undertaking.

Brussels has been, and is yet, probably, the greatest center for tramway investment in Continental Europe; this because of Belgian wealth, a long established preference for tramway investments and because Belgium is a neutral country, in whose companies and financial circles capitalists of other Continental countries can consistently unite in investment. Even British capital occasionally finds an outlet through this channel.

Financial groups and companies, with their headquarters in Belgium, control many of the more important tramways in all portions of Europe, especially in the southern countries and in Russia, and are taking a more active part in the present great internal development of this character in Russia, than are the financial interests of any other country.

The separation of Belgian, German and French investment in tramways outside of Europe is impossible, for the reasons already stated, but the aggregate of such investment cannot be far from $25,000,000. Were an attempt made to subdivide this, it would be suggested that approximately $13,000,000 of the amount is actually German capital, $7,000,000 French, and $5,000,000 Belgian.

The actual investment in all the tramways of Europe is difficult to reach, owing to a lack of statistics in certain countries, and to varying titles given to local transportation lines in others, all, or most, of which would be considered street railways in the United States. These subdivisions are such as light railways, steam tramways, tramways for the transportation of passengers and baggage, tramways for the transportation of passengers only, etc.

In some countries all of this class of railways are considered as tramways; in others, only such lines as transport passengers, or, at most, passengers and baggage, within municipal areas, are so considered. The best illustration of this condition is obtainable in France, where statistics upon the various characters of local transportation are available up to the first of the present year, which can be summarized, as shown in tables Nos. 1 and 2, in which the figures are close approximations.

Table No. 1.

	Length in Miles	Investment in Dollars	Gross Receipts		Operating Expenses	Net Earnings	Percent Op. Ex. to Gross Receipts
			Total	Per Mile of Track			
Local steam railways guaranteed by State	1,958	$45,866,641	$2,398,116	$1,224	$2,018,442	$379,673	84
Local steam railways not guaranteed by State	779	34,334,058	2,255,209	2,891	2,252,209	1,512,198	67
Total of local steam railways	2,737	$80,200,699	.....	.....	.....	.....	..

Table No. 2.

	Gross Receipts		Operating Expenses	Net Earnings	Percent Op. Exp. to Gross Receipts
	Total	Per Mile of Track			
Tramways for transportation of passengers and merch. guar. by State	$1,234,233	$983	$1,093,669	$140,564	87
Tramways for transportation of passengers and merch. not guar. by State	1,342,022	4,092	904,173	437,848	67
Tramways for transportation of passengers and baggage	1,168,601	6,834	1,073,819	94,782	92
Passenger tramways, Department of Seine	6,768,063	40,048	5,866,049	902,013	87
Passenger tramways outside Department of Seine	5,357,728	14,062	3,757,282	1,600,446	70

The investment in the local transportation lines of France has been materially increased since the foregoing figures were compiled; this by the new railways at Paris, opened during the present year, which are not included in the immediately foreging.

Were a rough estimate to be made upon the total investment in all Continental local transportation lines, which in the United States would be considered tramways, street railways or interurban systems, the writer would place the figure at from $700,000,000 to $750,000,000; about half of which represents the investment in electric lines. An enormous figure, it is true, but when it is remembered that a similar investment of nearly $2,000,000,000 exists in North America, demonstration is, of course, made of the fact that the American financier has had greater experience in tramway finance than has the European, despite the larger sums of capital available to the latter. And, as is well known, the American tramway undertakings have been financed entirely by private capital with the sole object by general investors of profiting from their earning capacity.

The sources from which European investments in both domestic and foreign tramway undertakings have come, and the methods employed for procuring such capital differ somewhat in the various countries.

In Great Britain these may be divided under two headings:

First. For municipal undertakings, in connection with which the procedure is simple: Borrowing powers—so called—having been secured by the municipality under a special act of Parliament, bonds—or more properly, shares of redeemable municipal stock—are issued and placed either through bankers or by invitations for public subscription as readily as is done with the securities of the more important American cities at home.

Second. Investments in tramway company undertakings, either for Great Britain or abroad, are floated entirely upon the supposed financial merits thereof, as demonstrated by actual or prospective earning power. But the process ordinarily followed is somewhat complicated from the American standpoint, the essentials thereto being: First, influential solicitors in financial circles, next an engineer of prominence, then a proper underwriting syndicate, which, if the project is to be given to the public, is usually followed by diplomatic overtures to the financial papers, and then a judicious presentation in a set form of prospectus, inviting public subscriptions.

It is to be questioned if this last mentioned detail of "going to the public," so called, is as popular as was the case formerly, for a compilation of figures made from the London *Times* shows that during 1899 the aggregate of successful prospectuses of this character floated in London amounted to but £1,343,100. During the same period many times this amount of capital was quietly raised by London bankers for tramway purposes without the formality of issuing public prospectuses.

On the Continent, where governments and municipalities have assumed the ownership of tramways and local transportation lines, these have been financed on lines similar to those adopted in Great Britain. Continental

tramway company undertakings, however, whether to be operated locally or abroad, are, to a great extent, financed from different motives than those which exist in America and Great Britain, consequently causing a variation in procedure between different Continental countries, as well as between American and British practice.

In Holland—as thoroughly as would be the case in America and England—the reason for tramway investments has been dependent purely upon the merits of the same. In Belgian companies the same is almost equally true, but in certain of the largest tramway circles there the influence of the Continental electrical manufacturer is apparent.

In France is found a close connection between the large financial institutions and certain important electrical manufacturing concerns, so that many of the larger tramway and electrical undertakings are financed for the joint purpose of benefiting from the earning power thereof, and to afford business for the electrical manufacturing companies. The wonderful financial ability of the Frenchman, and the exceeding care which he exercises in investigating every project in which he proposes investment, has prevented unfavorable results arising from a practice which operated so unfortunately in America a few years since.

In justice to the French it must be said that they investigate more thoroughly, and carry through their undertakings with less unnecessary formality than is done almost anywhere else; wherever French capital is found invested in tramway enterprises, it can be considered to be safely invested. As characteristic of other investments in France, tramway securities are widely scattered in small individual holdings, but the financial institutions that have caused their issue show their faith therein by retaining large blocks as their permanent investment. The essentials to reach the funds of either the French or Belgian financial circles is, first, suitable introduction; next, a meritorious project; then production of full facts which will permit investigation; after that few formalities.

In Russia the existing tramways, with the exception of those controlled by the powerful Belgian syndicates, have been principally financed locally, either as close private companies or by one or two wealthy individuals assuming the same as private or personal undertakings. In connection with the adoption of electric traction, which has just commenced, the financial circles of Belgium, France and Germany are playing a most important part, while British capital also seeks investment there.

From a financial standpoint a condition prevails in the smaller and less important countries of Europe not unlike that in France, as, to a great extent, the tramways in such countries have been financed either with German, French or Belgian capital, or perhaps more properly co-operating with local capital which ordinarily represents minority holdings in the various enterprises.

In Germany, and wherever private German capital is invested in tramways, the closest relationship in financiering exists between the large German electric manufacturing companies and the strong financial institutions of Germany. In fact, it is rare to find a local undertaking of this character in which some German electrical manufacturing concern does not either directly or indirectly, through its banking connections, exert financial control. One such manufacturing company publishes a list of such local interests controlled by or affiliated with it, aggregating a capital investment of over $60,000,000.

The total capital and debentures of the German electrical manufacturing industry is creditably announced as exceeding $200,000,000, which is excessive, for its conduct as a purely manufacturing industry. Associated with the manufacturing companies are banks, financial companies and groups said to have a total capital of over $500,000,000. As the total capital invested in the local electric railways and lighting plants of Germany itself does not exceed $250,000,000, some idea may be gained as to how extensive the investment of German capital must actually be in other countries.

So far, the practice of close co-operation between the financial interests of Germany and its electrical manufacturing industries in local investments of this character has resulted favorably to the manufacturing companies, to the financial interests in the development of local enterprises, and to the extension of German influence; but it is to be questioned if it has not been carried to the extreme, and that if the desire to extend the business of the manufacturing companies and to increase German trade and influence has not reached a point where in certain cases it is liable to react unfavorably upon the investors, be they powerful financial groups or humble individuals.

The decline of the past few months in the market value of shares in the financial companies and similar organizations, which have been most heavily interested in such matters, would indicate that such condition already prevails to a certain extent.

Germany, however, has a remarkable banking system, which, though a general business and financial depression should prevail in Germany, or even throughout the world, would prevent any such serious results occurring as would be the case under similar conditions in the United States, while, of course, Germany is to be congratulated upon having made more wonderful progress during the past few years, both financially and commercially, than has any other country in the world, excepting the United States.

Probably German foreign investments have been made less judiciously than those of England and France, and such enterprises on the whole are not so advantageously managed, but the courage of German investors and financiers is superb, while time will, of course, remedy those possible mistakes into which they have been led by a desire to rapidly advance the best interests of the Fatherland. Upon one detail of the German system of finance affecting tramways, it may be safely said that no large enterprise of this character can be financed in Germany without some one of the large German electrical manufacturers having more or less direct connection therewith.

The average American reader may possibly wonder where the large sums of American and European capital already referred to as being invested in countries outside of Europe and the United States is placed. He may not be familiar with the fact that in one South American city there is an investment of this character of over $25,000,000. In another, above $10,000,000 is similarly invested. Scattered elsewhere outside of Europe and the United States are other properties in which the investment is from $1,000,000 to $7,000,000.

POLYPHASE RAILWAY APPARATUS AND METHODS

BY LOUIS BELL, PH. D.

The advent and extensive development of polyphase apparatus and methods in connection with street railway service is perhaps the most striking modification of tramway practice within the last decade. A long and formidable list could be made up, and, indeed, one has recently been published in the STREET RAILWAY JOURNAL, showing the numerous roads which are dependent on the methods of polyphase power transmission for their working current.

Power transmission with polyphase apparatus and methods began to be practiced in this country about eight years ago, and it is interesting to know that concurrently with that development in the art, motors for street railway service were assuming practically their present form. It is a striking thing that street railway motors and controlling apparatus have remained for so long a time in substantially the same general form and possessing the same general characteristics. By this it is not intended to assert that there have not been many and great improvements, both in motors and in accessory apparatus, in the last seven or eight years. That there have been such improvements is too well known to need comment; nevertheless, the iron-clad motor with a magnetic circuit of cast steel, with but a single gear reduction between armature and coil, and used with series parallel control, we have now had with us for a considerable time. The working voltage for street railways has remained unchanged, and with the gradually widening circles covered by the street railway service about every city, the burden of copper for the carrying of the large amounts of power required at this very moderate voltage has been steadily growing greater. It has, however, gradually been becoming apparent that the distances of transmission sought to be covered in street railway work are generally too great for the direct distribution of current at or about the working voltage now used; hence the immense development during the last few years of polyphase apparatus for traction purposes.

Looking over the list of electric roads using such transmission one quickly finds that there are two distinct classes enumerated. One has the ordinary case of power transmission from a waterfall to one or more points along the line of the electric road concerned. This is a problem in pure power transmission, all, or substantially all the stations which serve the road being rotary converter stations. Under such circumstances the apparatus usually presents few striking features, and while the system may be interesting as a transmission sytem, it does not show the characteristic features which have been brought out in the other class of polyphase tramway work. This consists in the roads using methods such as have just been described in connection with a large central station.

It is not the writer's purpose here to discuss the economics of power transmission from one great central station to sub-stations with rotary converters, as against the use of the auxiliary stations with their own prime movers. This, of itself, is a very large subject, and one about which it is particularly unsafe to generalize, since the economics of the matter are really determined in the long run by local circumstances of somewhat complicated character.

In any case of power transmission from a central station with reconversion at rotary converter stations, there is, as is well known, a considerable loss of energy, and a very considerable added cost. Both these items of loss must be recouped for a successful economic result by decrease in the cost of generating power at the central point. When, however, it becomes clear on thorough investigation of the local conditions of operation that a saving of 25 or 30 per cent in the cost of power can be obtained by concentrating the generating plant, then power transmission by polyphase currents from this central generating plant to substations with rotary converters becomes desirable; and in such cases it has been, and is being, introduced on a very large scale.

The first result of the demand for this particular class of power transmission was the development of the big engine-driven polyphase generator, a machine already foreshadowed in occasional hydraulic work, but only brought to its present form in virtue of the requirements of street railway transmission.

When it becomes necessary to design a polyphase generator of one or several thousand kilowatts capacity for direct connection to an engine, the designer has to face serious problems of an unfamiliar character. In the first place, the speed of rotation at which it is possible to work very large engines of the kind now in general use is limited. Engines of 2000 hp or 3000 hp are built to run between 75 r. p. m. and 90 r. p. m. This low speed is very easily met in the design of large direct-current generators; but when it comes to the evolution of the polyphase generator of the same speed, the question of frequency comes up, and causes trouble. The result is a rather extreme form of multipolar design, for as the rotative speed goes down the number of poles has to go up, to preserve a frequency sufficient to insure proper utilization of the material in the transformers, which form a part of every railway transmission system. With this increase in the number of poles necessarily comes a very great increase in diameter of the field system. It is impracticable to retain a moderate diameter and to make the poles very long and narrow, on account of the large waste of material involved, the crowding of the armature coils—if the generator is to be of great capacity—and various minor electrical difficulties of a forbidding character. Hence the field magnet frames had to grow enormously larger than usual, and the outer circle of the machine had to be stiffened against flexure by deep flanges.

The designing and construction of an enormous field magnet ring is no easy matter, even for the largest direct-current generators; and the requirements of sound mechanical design have, even in this latter case, led to the development of a field magnet ring which is not only flanged, but which literally forms a circular truss, the better to resist deflections, due both to weight and to inequalities of magnetic stress.

Fig. 1 is a very striking example of the extremities to which designers have been driven by the requirements of very large, slow-speed machines. It shows the field magnet structure of a 2700-kw direct-current generator, built by the General Electric Company for the Boston Elevated Railway Company. The speed is 75 r. p. m, and the gigantic field ring has thirty-six poles. In polyphase alternators of corresponding size one has to face still further difficulties, since, if used in transmission plants for railway work, high voltage on the line is necessary. This means either that high voltage must be generated in the machine, or that it must be derived from raising transformers, which are a serious addition to the expense, with the low frequency now in use, and, moreover, tend to diminish the efficiency of the transmission as a whole. Hence there is strong reason for building a generator itself of high voltage, and with this requirement for high armature voltage has come the stationary armature with revolving fields, which is now the feature of power transmission apparatus on a large scale.

With the stationary armature the difficulties of winding for high voltage are obviously much diminished, and while it has been possible to construct generators with revolving armatures as high as 5000 volts or 6000 volts, for these high pressures it has now become the almost invariable rule to build generators with stationary armatures.

Fig. 2 shows the stationary armature of one of the enormous 3500-kw direct-connected generators built for the Metropolitan Street Railway Company, of New York City, by the General Electric Company. The armature laminations are here carried on a similar circular truss structure to that which appears in Fig. 1. The windings are not in place, and the form of the slot shows clearly. Resting beside the huge frames, however, are some of the armature windings, laid out in the relative positions which they occupy in the big generator.

Such a machine is a most striking example of the problems which the requirements of street railway service have forced upon the designer and builder of polyphase apparatus.

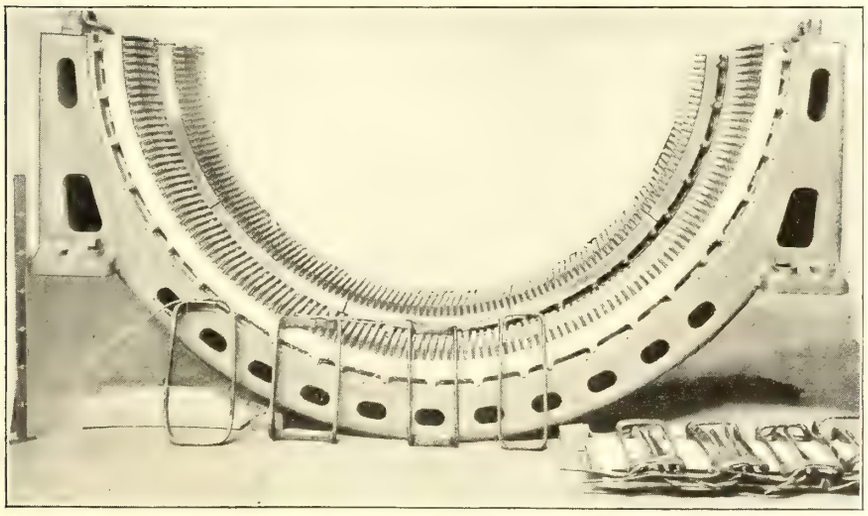


FIG. 2.—STATOR OF 3500-KW DIRECT-CONNECTED ALTERNATOR FOR METROPOLITAN STREET RAILWAY, NEW YORK

In spite of the disadvantage of low rotative speed, the immense dimensions of these modern direct-connected units give peripheral speed to the armature, ranging as a rule from 2500 f. p. m. to 3000 f. p. m., and consequently there is speed enough for the efficient production of electric motive force. The result is that while slow rotative speed has generally a tendency to reduce efficiencies, these big

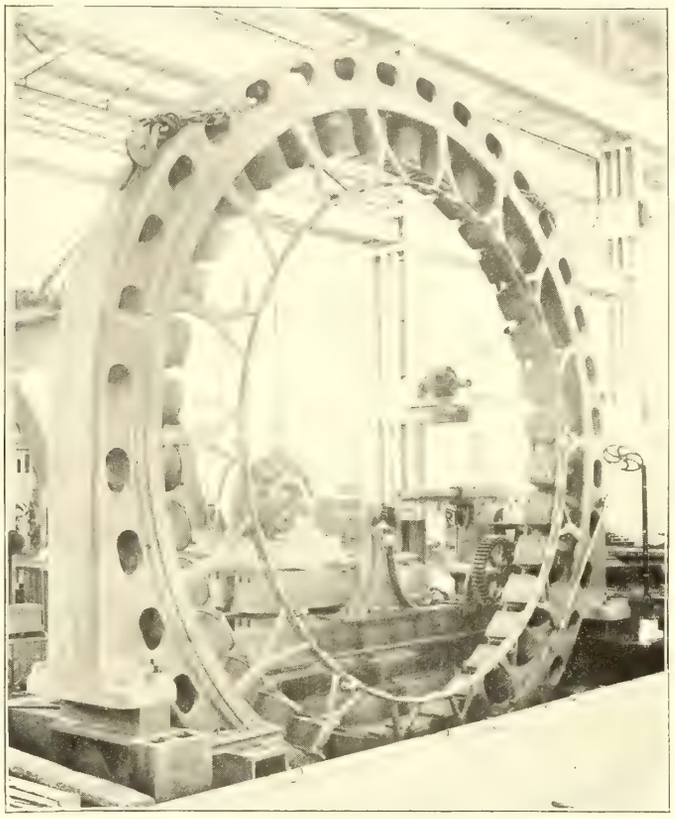


FIG. 1.—FIELD MAGNET FOR BOSTON 2700-KW 500-VOLT GENERATOR

generators are not only highly efficient but have a remarkably steady efficiency under varying load. For example, the machine shown in Fig. 1 has a commercial efficiency even at half load of 94 per cent, which rises at three-quarter load to 95 per cent, and at a full load to 95.5 per cent, where it steadily stays, up to an over-load of 50 per cent. The large polyphase machines have similarly high efficiency. Aside from modifications in form induced by the serious structural problems encountered in building fields and armatures of so large dimensions, many other unusual modifications have been superinduced by the great dimensions. For example, in the multipolar generators, especially the polyphase generators with a very large number of poles, the matter of winding space on the individual poles becomes serious. The amount of energy required for excitation is not very large, but the space is so limited that it is not easy to get on sufficient cross sections of copper for efficient working, when using windings of the ordinary form. Consequently, for big machines like that shown in Fig. 2 and other similar ones, the very curious and ingenious field winding shown in Fig. 3 has come into use. It is a copper strap, carefully insulated by wrapping, and laid on edgewise in the manner shown in the cut. The edgewise coil thus assembled is placed on the pole piece, and affords a winding of great cross section without the wast-

ing of much space for insulation or by reason of bad packing of wire. It may obviously be objected that the radiation surface of such a winding is small. This is perfectly true, but the energy wasted is relatively so small that the question of heat is eliminated from the problem, particularly with the advantages for cooling afforded by rotating poles.

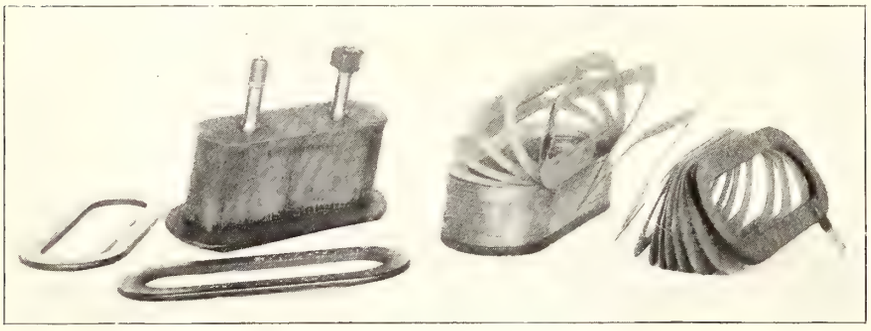


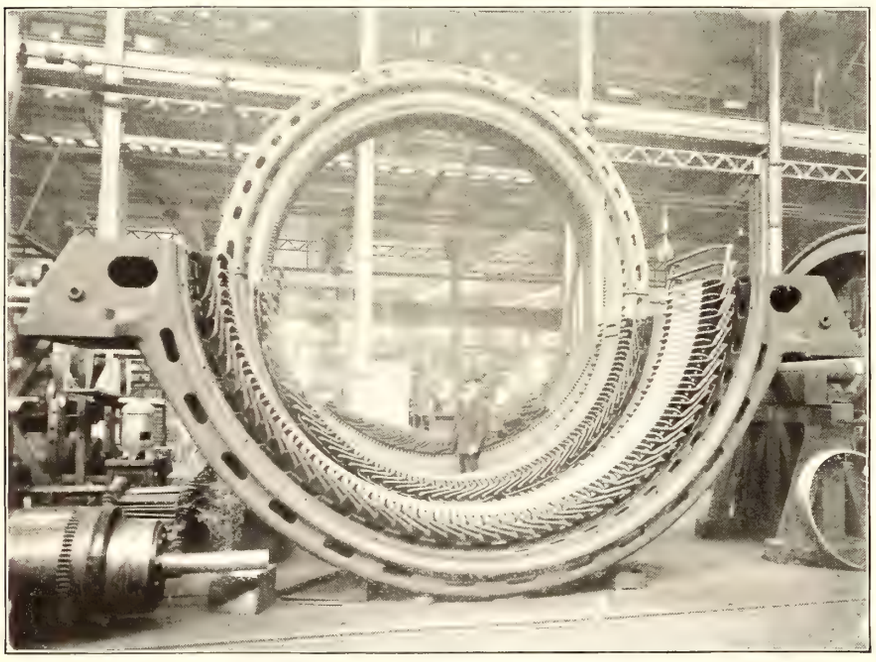
FIG. 3.—FIELD WINDING USED IN LARGE GENERATORS

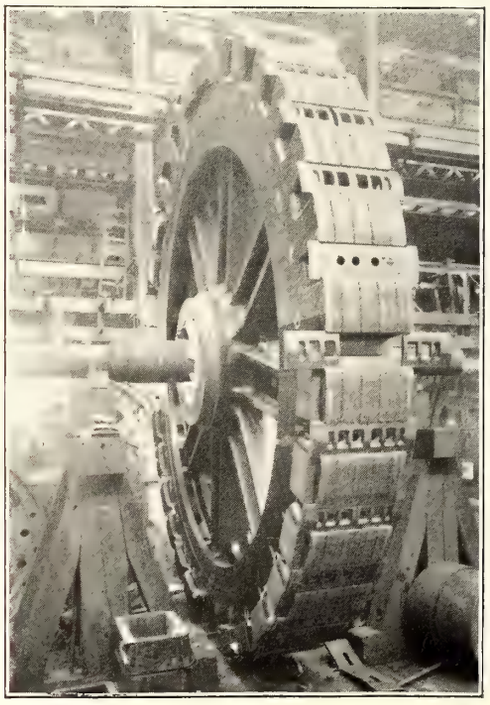
Another beautiful example of direct-driven polyphase generator is shown in Fig. 4, which exhibits the stationary armature of a 750-kw slow-speed three-phase generator of 25 cycles per second, built by the Westinghouse Company. This is to generate 6600 volts directly from the armature, and the engraving gives an exceedingly clear idea of the way in which the coils of the successive phases are laid into the armature slots. These coils, like all coils of modern machines, are wound on forms, thoroughly insulated, and slipped into place. The general design of the armature frame shows the same device of a circular truss, which has already been referred to, and the engraving gives a very impressive idea of its size.

The revolving field of this particular machine is shown in Fig. 5, which is particularly instructive as showing the care taken in the ventilation of the laminated poles and the extremely ingenious and useful method of locking the field coils into place by heavy, cast, bridge pieces, which span the space from pole to pole and secure the coils in the most thorough manner, besides being otherwise useful. The whole structure of the revolving field is made solid and heavy, and serves to give an admirable fly-wheel effect in the operation of the machine.

The exceedingly substantial design of this generator and others of this class appeals very strongly to the mechanical engineer. There has been no skimping in amount of material, and all material has been put where it will do good.

Fig. 6 shows the detail of the winding of the field shown as a whole in Fig. 5. The laminated poles with slots for ventilation, the compact and substantial field coils and the solid bridges, which hold them in place, are here excellently shown. These cuts of the large polyphase generators readily explain the ease with which high voltages can be generated directly from stationary armatures. With machines of the revolving pole form it is easy to get sufficient space for well-insulated coils, and questions of the overlapping at the ends of armature coils having great difference of potential are eliminated, since in the absence of centrifugal stress and in the presence of ample room at the ends of the armature, the coils can be kept extremely well clear of one another. The efficiencies of the large polyphase machines that have already been mentioned are very high, and as a whole their performance is exceedingly satisfactory in every respect.





FIGS. 4 AND 5.—STATOR AND ROTOR OF 750-KW, SLOW SPEED, THREE-PHASE GENERATOR

In building plants using direct-connected units of so great output as those to which reference has been made it becomes necessary to deal with large quantities of current at fairly high voltages, and the result of this requirement has been the development of an entirely new line of station appliances in the way of switches and cut-outs. It is no joke to handle currents of several thousand amperes at several thousand volts, and the old familiar apparatus has not proved adequate to the new task of so large proportions. Switches now in use dealing

in such work are relay switches operated by fluid pressure, so that the man in charge of the switchboard can work the complete equipment of switches for a complicated system of generators and feeders by means of a set of valves all within reach of his hand. Such apparatus is rapidly coming into use, and it is needless to say that it implies a far greater facility of control than has ever hitherto been obtained in a large central station.

In polyphase distribution for tramway work, whatever the character of the line—two-phase or three-phase, overhead or under-ground—the essential apparatus at the other end of the line is the transformer and the rotary converter. The voltage of the line may be 5000 or 20,000, obtained from machines with stationary armatures or from generators with raising transformers, but wherever the rotary converter is, there must be the raising transformers to send into the collecting rings current of the proper voltage to reappear as direct current of standard railway voltage at the commutator end of the machine. This is one of the inconveniences of the rotary converter, which has to be tolerated on account of the other virtues of the machine.

A considerable number of types of transformers have been used in the past, but they have gradually simmered down to two so far as high voltage work is concerned. The principal problems which have to be met in the construction of large high-voltage transformers are adequate insulation for the potentials employed, and some proper and efficient way of getting rid of the large amount of heat generated. Inasmuch as the output of the transformer varies almost directly as its mass, which increases as the cube of the linear dimensions, it is clear that transformers of a very large output are likely to be somewhat short of radiating surface for getting rid of heat generated, which, small in relation to the output, may become absolutely rather large. In one of the usual and familiar types of transformer the structure is thoroughly ventilated with air passages, through which a blast of air is forced, rapidly cooling off the heat generated in the coils and core. In the other type, which is also widely used, particularly for very high voltages, the core of the transformer and its coils are similarly provided with ventilating passages, which, however, are filled, not with air, but with oil, the whole transformer structure being immersed in a tank of dimensions sufficient to permit adequate radiation from its exterior.

A fine example of this construction is shown in Figs. 7 and 8, of which Fig. 7 shows the coils and core, and Fig. 8 the containing tank of a Westinghouse 375-kw transformer for a primary voltage of 15,000. The coils and core are made up into a compact and well ventilated mass, conveniently arranged for handling, and this, in itself thoroughly insulated as regards the coils and core, is plunged into a metal tank, shown in Fig. 8. This has on its surface very deep corrugations or their equivalent, so that the actual cooling surface is very much greater than the linear dimensions of the tank would imply. The oil with which the tank is then filled rapidly transfers the heat from the core and coils of the transformer to the surface of the tank, where it is thoroughly taken care of by natural radiation.

As regards rotary converters themselves, they are very generally familiar to the reader. An interesting type of modern practice is, however, shown in Fig. 9, a 250-kw transformer of Westinghouse manufacture, designed for the somewhat unusual frequency of 60 cycles per second. Aside from this peculiarity, however, the striking feature of the machine is the method employed in starting. The starting of rotary converters always entails more or less trouble, since, while they will come up to speed themselves if the main current is thrown on, a large amount of current is required to perform the feat. Hence whenever feasible they are started by auxiliary motors or from the direct-current side. The present machine has assembled directly upon an extension of its armature shaft the armature of an induction motor, of which the field is mounted upon the frame casting of the converter itself. The starting motor is thus made a simple and integral part of the rotary converter as a whole, avoiding all inconvenience of belts and belt shifters, on the one hand, or of severe call for current from the line, on the other. The simplicity and convenience of such a starting arrangement is obvious without further comment.

But there is another branch of polyphase transmission for tramway purposes which has not yet found its way into commercial practice in this country, although it is becom-

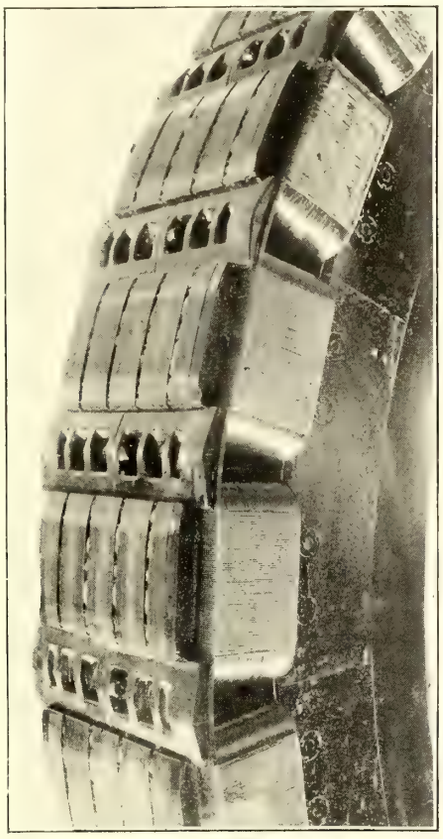


FIG. 6.—DETAIL OF WINDING OF FIELD SHOWN IN FIG. 5

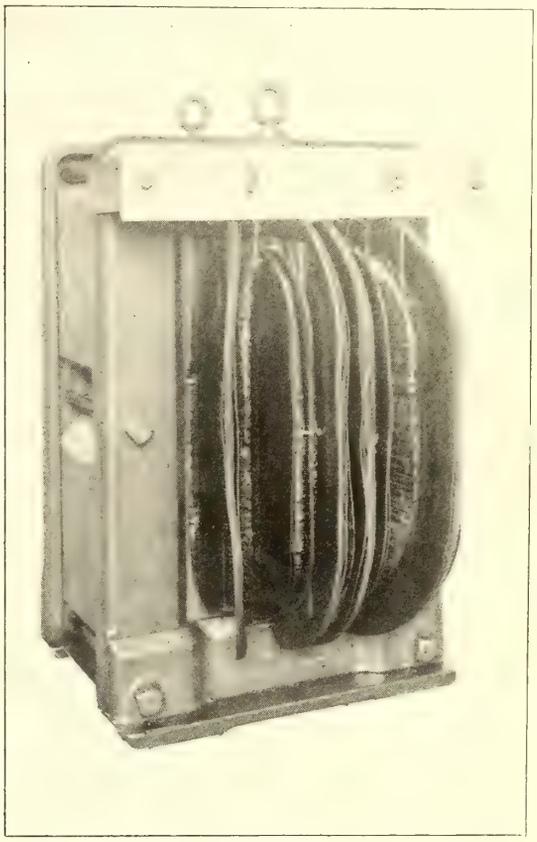


FIG. 7.—COILS AND CORE OF 375-KW TRANSFORMER

ing well known abroad. This is the direct operation of the motor cars by means of polyphase motors, thus superseding at one stroke the whole complicated mechanism of transmission, reconversion, and subsequent transmission through the ordinary feeding system. It must be remembered that in spite of the useful economic results obtained by transmission to rotary converters, the feeding system has in great measure remained unchanged. There has been, of course, saving of feeder copper from the use of sub-stations, but the increase of sub-stations with rotary converters is not a thing which, involving as it does somewhat costly apparatus and the necessity of attendance, can be carried on indefinitely. If the amount of feeder copper necessary for extended distribution is to be greatly reduced it becomes necessary to derive from the transmission lines the working current for the distributing system by means more simple than sub-stations with rotary converters. At the present time the use of induction motors directly upon the cars has not yet been completely worked out. It involves generally the use of two trolley wires, which is of itself an inconvenience, and with the almost universal present use of direct current for tramway purposes, polyphase currents may never find more than a casual use in this field; still the indications are that for special purposes, and particularly long-distance roads, traction by polyphase motors is likely to increase. The experiments which have recently been tried in Europe, and particularly those in which the voltage of the working conductors has been very considerably increased, looking toward carrying the reducing transformers on the car, indicate that we cannot pass by the possibilities of this form of traction. In this connection, therefore, it is of interest to know that American manufacturers are not by any means behind the game. Fig. 10 shows a pair of polyphase tramway motors with their controller, under test in the shops of the General Electric Company at Schenectady. Although not mounted on the cars, these are something more than experimental machines, since they were developed upon a regular contract placed abroad. It will be seen that the motors are in general arrangement closely similar to direct-current railway motors, the same general characteristics having entered into the mechanical design. Their performance has been such as to indicate that we can, in this country, successfully compete with anything which has yet been done abroad in this particular line of operation. The matter is referred to here with no intention of broadly recommending polyphase motors for tramway service, but the writer desires to point out in most emphatic terms that there are cases where the adoption of such motors would constitute a most material advantage, and would, in fact, make the difference between failure and success. Such cases are principally to be found in the extension of electric traction to long-distance railroads.

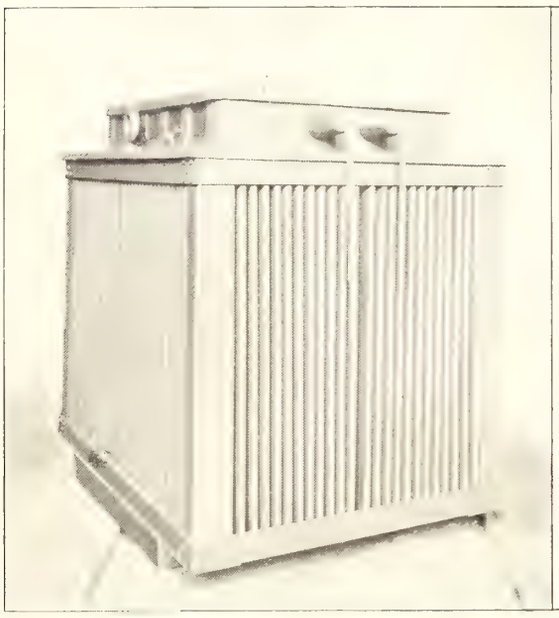


FIG. 8.—CONTAINING TANK OF 375 KW TRANSFORMER

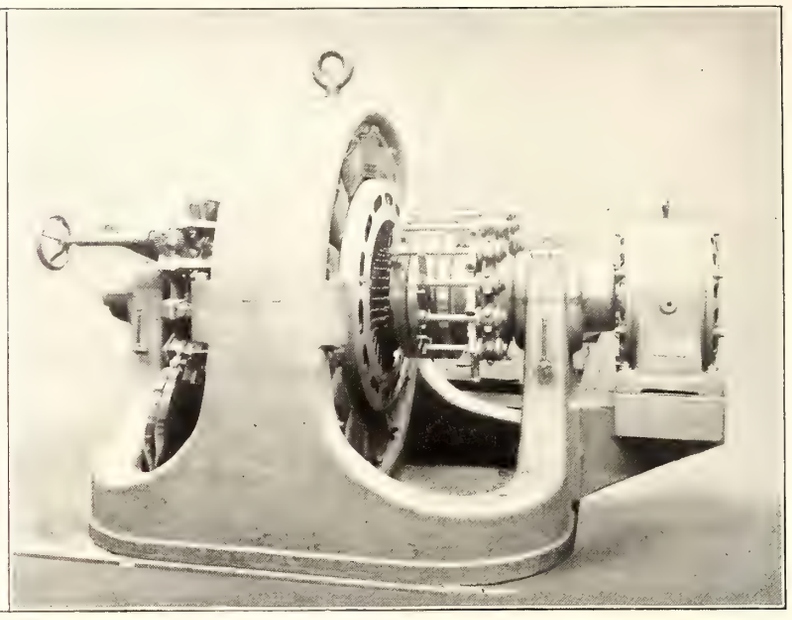


FIG. 9.—250-KW ROTARY CONVERTER

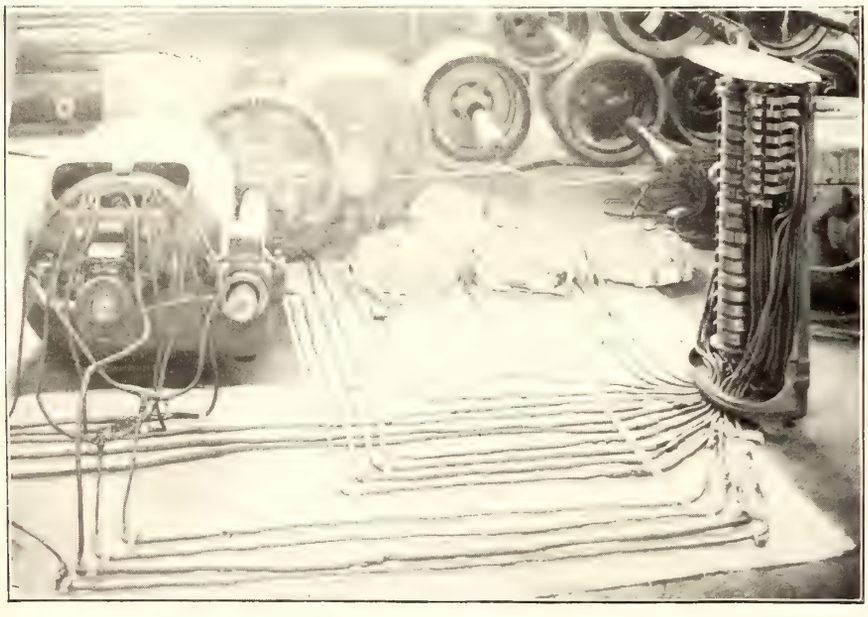


FIG. 10.—POLYPHASE MOTORS WITH CONTROLLER

THE STREET RAILWAYS OF RIO DE JANEIRO

Rio de Janeiro, the capital of Brazil, is one of the largest and most important cities in South America. Those whose business interests lie entirely in the Northern Hemisphere do not often realize the size and extent of cities lying south of the equator, so that it may possibly be a surprise to some to learn that this city has a population of 800,000, and in the appearance of its streets and parks will bear comparison with any other city of equal size in the world. So far as its natural location is concerned, Rio de Janeiro is probably the most picturesque of any large city, undoubtedly surpassing even the famed Naples. As will be seen from the accompanying views, the bay is dotted with many islands. Many of these are merely barren rocks, fashioned into picturesque and fantastic shapes, but the great majority are covered with vegetation, and are inhabitable. Owing to the mountainous character of the land on which "Rio" was built, the city is exceedingly irregular in shape, and its suburbs are widely separated from each other, making the city an ideal one for tramway operation. The greater part of it lies on an extensive, low plain. The suburbs to the westward are probably the most picturesque and salubrious, and are occupied by the more expensive residences. There are also other important suburbs to the west and northwest.

The harbor, of which an excellent idea can be obtained from the engraving on this page, is one of the best on the coast of Brazil. From its position Rio is naturally the great mart of Brazil, and is a large export city for the products of the country, notably for cotton, sugar, coffee, rum, timber, hides and minerals of various kinds. It is also the terminus of several lines of railways.

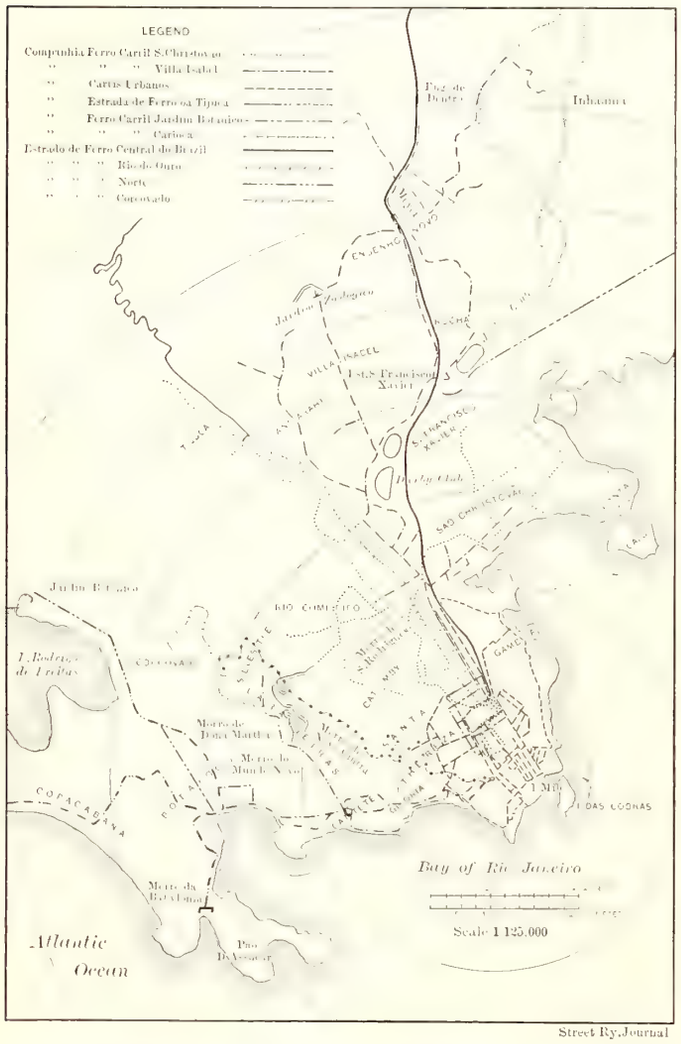
The streets in the old town are for the most part narrow, and the majority of the buildings of the old style, built principally of broken stone and mortar, plastered on the outside or faced with illuminated tiles. Recently, however, better taste has been shown and more cut stone for building material used. The principal streets are well paved with granite blocks, but most of the back streets still retain their old cobblestone pavements. In the newer parts of the city are many very handsome residences.

ENTRANCE TO THE HARBOR OF RIO DE JANEIRO

The city and the suburbs are amply supplied with tramway lines, most of which are yet to be equipped electrically. Nearly all of these lines run from points near the Rua do Ouvidor, as a center, to the suburbs and principal places of interest. Few cities are better supplied with tramways, and there are equally few, perhaps, where the difficulties of creating a thoroughly convenient system are greater. The configuration of the land upon which Rio de Janeiro is built has, in a great measure, compelled the building of these lines so as to radiate from a common center. On the other hand, the intervening hills obstruct cross connection between the suburban extensions, thus frequently compelling the riders from one adjoining suburb to another to take the long trip into the city or to some other central

point in order to pass from one locality to another close at hand. The fact that many of the suburbs are widely separated from the city by the severe and abrupt hills, a good idea of which can be obtained from the engravings, has also compelled the construction of very long lines. With animal traction, a trip to these suburbs nearly always involves three hours of continuous riding with but one or two breaks.

The five principal tramway lines in the city are the Jardim Botanica, Carris Urbanos, Sao Christovao, Villa Isabel, and Carioca, or Santa Thereza. The total number of paying passengers on all lines entering the city does not aggregate much less than 350,000,000 per annum. The total number of passengers carried by the four principal street railway companies in "Rio" during the twelve years from 1887-1898, with the average number of passengers



Street Ry. Journal

MAP SHOWING ALL OF THE LINES ENTERING RIO DE JANEIRO

carried per year during this period, is given in the table below:

Name of Line	Passengers Carried 1887-1898	Average Per Year
Villa Isabel	87,837,523	7,319,793
Sao Christovao	215,153,999	17,929,499
Jardim Botanico	199,634,118	16,636,176
Carris Urbanos	264,631,650	22,052,637
Total	767,257,230	63,938,105

This average has been greatly exceeded during the last few years, and recent figures show a constantly increasing traffic.

Rio de Janeiro is, theoretically, divided for the purpose of the allotment or disposition of tramway franchises, or concessions, into so-called "zones" of monopoly. These "zones" are very clearly shown on the accompanying map. Thus, the Jardim Botanico tramways monopolize the southwestern, or the bay and Atlantic Coast, section of the city and suburbs. To a degree, the Carris Urbanos Company has monopolized the old and congested part of the city, while the Sao Christovao "zone" is actively enjoyed by

VIEW IN RUA OUVIDOR, THE PRINCIPAL RETAIL BUSINESS STREET

both the Villa Isabel and Carris Urbanos lines, and is threatened by the Tijuca Electric Railway—now in operation in the distant Tijuca territory. This particular "zone" is also being penetrated as well by the Central Railway of Brazil. This railway, which is owned by the government, is one of the most important railways in South America, and runs daily ninety accommodation trains, admirably disposed as to hours of movement—for the accommodation of the suburbs reached by it. These suburban lines reach out approximately 12 miles, and the system appears in every way to be exceptionally well conditioned and well operated.

As already stated, the central districts of the city are served by the narrow-gage lines of the Carris Urbanos. These lines are very convenient for short trips through the central districts of the city, for visiting the theaters, public gardens and squares or public buildings, as well as for reaching the main station of the Central Railway of Brazil. The universal fare on this line is 100 reis, equal at the present exchange to approximately 2 cents in American money. This line is operated entirely by animal power.

The Jardim Botanico, or Botanical Garden Tramway—city portion—3 miles of which is operated by electricity, serves to connect the city with the suburbs to the south-

west. Most of the sections through which this line was built are comparatively modern, and the streets and residences are very pleasing to the eye. The horse cars themselves do not reach the downtown section, but stop at a point some considerable distance before the city terminus is reached. Here the horse cars are coupled to electric motor cars, and, as trail cars, proceed in trains of four or five cars to "Largo Carioco," the city teminus.

The Jardim Botanico is said to be the oldest tramway line in South America, and was built by an American company, which owned and managed it until 1882, when it passed into local control.

The Sao Christovao lines, which are operated by animal traction, communicate with several of the common suburbs to the north and west, and also serve several cemeteries.

The Villa Isabel line, which is also operated by animal power, connects with a suburb of Villa Isabel to the west and with the intermediate points, and to a large extent serves the same territory as do the lines of the Sao Christovao Company, prospectively the Tijuca Electric Railway and the Central Railway of Brazil. The latter is a large steam railroad system, already mentioned, belonging to the government.

The Carioco line, which has been equipped with electric power, starts from Largo Carioco and also from the head of Plano Inclinado, an inclined plane railway operated by cable power, and extends to Sylvestre. The streets are steep and crooked and the grades and curves are very severe. These grades in many places are as steep as 7 per cent and 8 per cent, a few being more severe. The cars on the inclined plane run every half hour, starting on the exact hour and half hour, except for a short period in the morning and evening, when they are run on fifteen-minute intervals to accommodate the increased traffic. The inclined plane cars were formerly drawn up the hillside by means of a stationary engine and a $\frac{3}{8}$-in. wire cable, passing around a horizontal drum, and attached to a descending car as a counterbalance. This power is now electric. The total length of this inclined plane is 1683 ft. (513 m), and the grade varies from 14 per cent to 16 per cent. There are three viaducts, two of iron and one of wood, and the "upper" one is at a considerable height, particularly on the eastern side, where the hill slopes sharply into a narrow valley. The view on this side is very picturesque. This road was opened to traffic in 1877.

A VIEW ON THE CORCOVADO COG RAILWAY

A VIEW OF THE CITY FROM SUGARLOAF MOUNTAIN

On the top the traveler enters an electric car, which carries him around sharp curves and up steep grades until the greatest elevation is reached at Hotel Sylvestre. The greater part of the way the train follows the old aqueduct road, the hill rising abruptly on the left and descending sharply on the right, leaving but few places on which residences can be built. The views out over the city and upper bay are indescribably beautiful. The Tijuca Mountains are seen on the left, the open country appears beyond Villa Isabel and Engeno Novo, and in the distance are the Tingua Mountains, whence comes one of the water supplies. But, as magnificent views can be obtained from so many hundreds of places in and about the city, particular mention would fill a large volume.

The Corcovado cog railway has a three-rail track, which climbs the mountain side with grades of 25 per cent to 30 per cent. The locomotive, which weighs approximately 13 tons, possesses a central cog-wheel, which runs on a

central cog-rail (Riggenbach system). The total length of the road is about 2 1/3 miles, and the altitude of its terminal station 2198 ft. (670 m), making an actual ascent of 2077 ft. After leaving the train, a slight ascent on foot brings one to the summit of the peak, a small, walled-in space of a few yards, 2329 ft. (710 m), railway measurement,

STREET VIEW IN FRONT OF JARDIM BOTANICO

above the sea level, commanding views of sea, city, bay, forest and mountains. The whole expanse of the bay then lies stretched out like a map, and the eye can follow its curving shores for miles.

But little has been done to encourage traffic, as compared with the practice in the United States. The railway companies have done nothing in the way of establishing parks or pleasure resorts. Possibly this is due to the fact that boards of directors, and, to a large degree, the managers as well, are usually men engaged in other business, and are not practical railway men.

The track construction in Rio de Janeiro is of a great variety. The Jardim Botanico, which is partially an electric line, employs $3\frac{1}{2}$-in. to $3\frac{7}{8}$-in. T-rail (section 428 of the Barrow Steel Company—about 40 lbs.), laid on wooden ties, 5 ins. x 6 ins. x 7 ft., and spaced about 4-ft. and 5-ft. centers; a flat rail, laid on wooden stringers, the old "American" pattern—or a rail of the Spillman type, is also extensively used. This latter rail has an irregular section somewhat like an inverted L, with web which has no lower flange or base. It is set into a cast-iron chair and is held in place by a wooden wedge. Most of the rail in "Rio," however, is of the "T" type, weighing approximately 30 lbs. to the yard. The ties, which are of native woods, are laid 3-ft., 4-ft. and 5-ft. centers, and, when the rails are of the flat type, carry the stringers, which in turn support the rails.

The fares charged on the tramway lines vary from 100 reis, approximate 2 cents in American money, to 300 reis, 6 cents. The lowest fare, which is 100 reis, is that charged on the Carris Urbanos lines, and is independent of the distance traveled. This same fare is also in force during certain times of the day on parts of other lines. The collection is made by conductors, who are expected to detach a ticket from a supply given them, for each fare taken. The writer has witnessed many "omissions," however, and the invitation for peculation afforded by this system can readily be imagined, there being no registers used. Passes are given out to a large extent for various reasons by the managers of all the roads, and the gratuitous passengers carried amount to perhaps 10 per cent of the total number carried in the city. Schedules are a subject, also, to which much attention is not given, and it is no unusual thing for a train of five cars, motor and four trailers, to stop several times within a "block," or 300 ft., to pick up passengers, not only wasting much time, but also much energy, animal or electric.

LARGO CARIOCO, NEAR THE CENTER OF THE CITY, AND THE TERMINUS OF THE PRINCIPAL ELECTRIC LINE

Another very peculiar feature of railway operation in "Rio" to an American manager, although it is the common rule in all the Spanish speaking countries, is the legal practice to hold the servant and not the master responsible for accidents. Thus, under this ruling, there is no liability

on the part of the company for damage suits, the law holding the driver, motorman or otherwise the responsible party. The practical effect of this rule, in case of an injury to a person or property, is that the "servant" contributor to it usually runs away and disappears. Thus the companies have no damage suit account to eat into their earnings, as in other countries; in fact, none of the companies even keeps an account of the "casualties" occurring through accidents on its lines.

All of the electrical machinery and apparatus now in use on the tramways in Rio de Janeiro are of the General Electric type (Thomson-Houston), and, as has already been said, are in use only on the lines of the Jardim Botanico, the Carioca and Tijuca railways. As the latter two are very small properties, and as the Jardim Botanico at present has only about 4 miles under electric operation, the extent of electric railways in the city is not large.

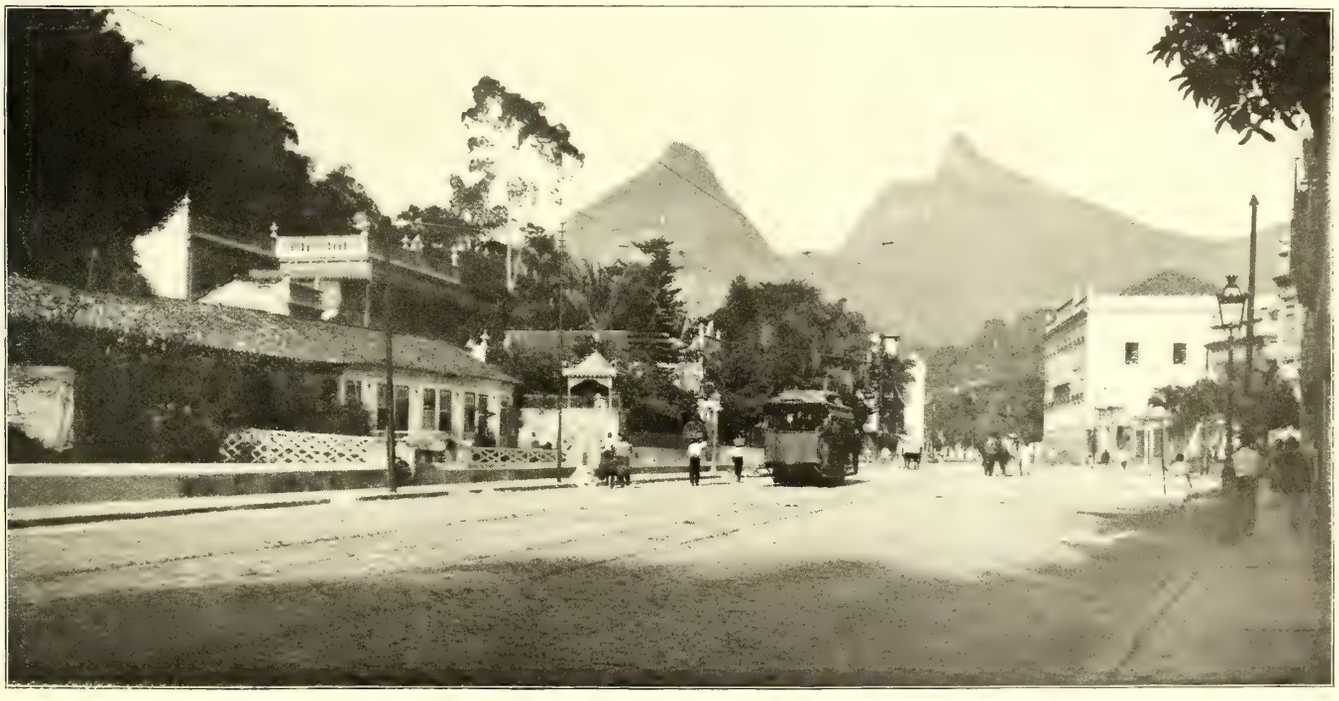
The franchises as a rule have a life of from thirty to fifty years, and require the maintenance of that part of the streets occupied by tracks lying between them.

The animals used on the animal traction lines are what is known in the United States as the Mexican mule, an animal of small size, usually from 13 hands to 14 hands high, but admirably adapted for this work. They are usually brought from the Argentine Republic, though some are obtained in Brazil.

Almost all materials, car wheels and fixtures and supplies generally of the many kinds needed by a tramway company have to be imported from Europe or the United States of America, but generally from Europe.

VIEW IN RUA PRIMERA DO MARZO

slow going of the existing system, which should add greatly to their earning power. While the present equipment, track, etc., is antiquated and useless, this is rather an advantage, as it reduces the value of the material which would have to be scrapped. The only possible drawback is the high price of coal, all of which has to be imported. That this is not an insurmountable hindrance, however, is shown by the experience in other cities similarly situated in regard to their fuel supply, where it has been shown that the advantages of electrical working are very patent, even in competition with horses and mules in a region where animals and fodder are exceedingly cheap.



RUA LARANJEIRAS, A FINE RESIDENTIAL STREET

The wages of the employees vary from an equivalent in United States money of from 40 cents to 60 cents and 75 cents per day for common labor. Conductors and drivers are paid from 60 cents to $1 for twelve hours' work. It would seem as if in most respects the city is admirably adapted to a system of electric transportation. The long distances to be traversed would give to the higher speed of the electric cars an enormous advantage over the present

THE BERLIN ELECTRIC ELEVATED ROAD

The constant growth and development of the German capital has demanded so large an increase in transportation facilities that the present rapid transit roads which are independent of the street car lines, that is, the Berlin City Railway (Stadtbahn) and Belt Line (Ringbahn), have long since been inadequate to take care of the traffic. In the most frequented streets, where one street car follows another, and where, besides omnibuses and carriages and numerous other vehicles are met, rapid progress has become an impossibility, and the construction of a new means of transportation in the form of elevated and underground roads has become a necessity for the city of Berlin.

In view of this fact, the firm of Siemens & Halske some time ago petitioned for a franchise to build and operate an electric road extending east to west, and branching out into the south and southwest, to be in the form of an elevated road within the city limits of Berlin and an underground road in Charlottenburg.

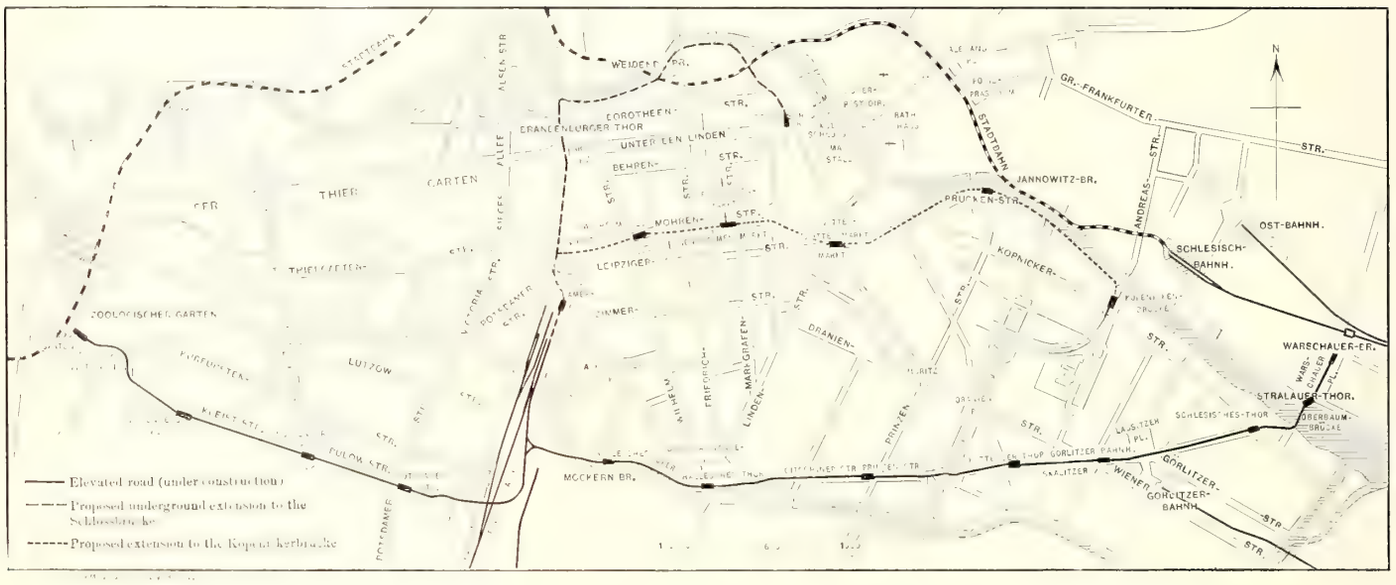


FIG. 1.—MAP OF BERLIN, SHOWING ROUTE OF THE BERLIN ELEVATED RAILWAY AND STADTBAHN

In making these agreements with the municipalities it was distinctly understood that the latter would abstain from the building of street railway lines. The State Railway Commission also declared that it did not consider the new road a competitive one to the existing roads. On the other hand, the Siemens & Halske Company considered that the electric elevated road to be erected was but the first portion of a continuous network of rapid transit lines such as it had planned for some time. In view of this, a responsible banking institution was appealed to to furnish the necessary financial backing, resulting in the Deutsche Bank joining the firm in the founding of a company for electric elevated and underground roads in Berlin. This company was organized on April 27, 1897. Its present capitalization is M.25,000,000, one-half of which consists of 4 per cent bonds, the other half of ordinary shares.

This company has an agreement with Siemens & Halske, by which it acquires and assumes all contracts and rights acquired by the firm which relate to the building and operation of the road, while the latter has agreed to build the road and operate it at its own risk for one year, with a guaranteed net profit of 4 per cent. Only after the road has been in operation for one year will the same pass into the hands of the operating company. In consideration of operating the road for this time, Siemens & Halske will receive 25 per cent of the net profits in excess of the guaranteed 4 per cent. As a great deal of territory will be required by the company for the building of the road, the municipality on Aug. 28, 1897, granted it the entire right of way from the Warschauer Bridge to the Zoological Garden and a branch to the Potsdamer station. The new electric road will be standard gage and double track. The maximum speed permitted, which is in accordance with the regulations for standard gage roads, is 50 km per hour.

The territory traversed by the road is shown in the map, and it will be noticed that a triangular switchback is being constructed, which makes it possible for the cars to run directly to the Potsdamer railway station to the Zoological Garden. The trains will run in both directions, with a headway of five minutes. More trains can be added as the traffic requires, so that the headway can be reduced to two minutes. The elevated road will have ten stations and the underground road three. The total length of the road will be 10.4 km, of which 8.8 km are in Berlin, .2 km in Schoneberg and 1.4 km in Charlottenburg. The State franchise for the operation of this road and permission to use public, as well as private, thoroughfares, squares and lots, which are necessary for the construction and operation of the road, covers a period of ninety years, beginning with March 15, 1896. For the use of this territory

the company has to pay the following amounts each year:

First—To the city of Berlin, if the yearly receipts amount to M. 6,000,000, the city receives 2 per cent; if M. 7,000,000, $2\frac{1}{4}$ per cent, and so on, for each million marks $\frac{1}{4}$ per cent additional goes to the city. After four years from the granting of the franchise, that is, the beginning of the fifth year, the least amount given to the city is M. 20,000.

Second—To the city of Schoneberg; this city receives 8/36 per cent of the total receipts up to M. 7,000,000, 9/36 per cent of M. 8,000,000, and 1/36 per cent additional for each increase of M. 1,000,000. After four years the amount to be paid to the city must be at least M. 3,500.

The Commissioners of Berlin, Schoneberg and Charlottenburg have reserved the right to purchase the entire road from the company. The road cannot be acquired, however, until after thirty years have elapsed from the granting of the franchise, and the right can only be exercised during ten years thereafter. In case the cities have such an intention they must notify the company two years in advance before they wish to carry it out, and cannot possibly retract thereafter. After the expiration of the franchise the entire road and accessories will become the property of the city. The city reserves the right to cancel all permissions granted, should the road not be finished in the specified time, or in case the company should fail twice in succession to pay the percentages due the city, and, thirdly, in case the company should make an assignment. In the latter case, the city has the right to restore all thoroughfares to their former condition at the expense of the company.

The following details relating to the construction of the road are of interest: The distance between center and center of track is 3 m. The tracks have a standard gage of 1.435 m, and the roadbed has a width of about 7 m. Standard gage was chosen, so that it will be possible at any later date to run the elevated or underground cars over the street railway company's tracks.

FIGS. 2-5.—DIFFERENT VIEWS OF THE ELEVATED STRUCTURE

At several points the road will have very sharp curves, one in the so-called triangular switchback having a radius of 90 m, and another having a radius of 80 m. In general, however, the curves have a radius of 100 m. The total length of the curved portions of the road is 27 per cent of the entire road. The height of the elevated tracks is practically determined by the fire department regulations, which state that the pillars of the structure must be at least 2.8 m above street surface. Where the road passes

over the Wannsee road and the Belt line the height is 4.8 m, and at various other points, for specific reasons, other heights were chosen. The superstructure of the elevated road consists in general of iron viaducts. Stone pillars are used only at depots and river crossings, as shown in Fig. 2. Stone viaducts are employed at several places, especially where the road passes between a row of houses. Where iron pillars are used each track is laid on a single longitudinal girder and only a single row of pillars has been built. As far as the height conditions permitted, the main pillars are situated under the tracks, and are 3.5 m apart. Fig. 3 shows standard construction for a 12-m span at the Oberbaunstrasse, and in Fig. 4 is shown a peculiar type of construction, which was adopted in order to gratify the wishes of a number of property owners who desired to have that portion of the road especially attractive, as the houses along this line are the property of well-to-do citizens.

In addition, the construction has been so chosen that no water can trickle down on the streets below. For this reason, the entire structure is lined with sheet iron, which is laid between the ties and girders. This iron is covered with gravel, so that it not only serves as a roof for the street below, but also dampens the noise considerably. The sheet-iron plates are 3 mm in thickness and do not have to support any of the weight of the tracks. Nevertheless, they strengthen the entire structure considerably. Pipes drain the water from this overhead construction and lead it into the sewer pipes.

Quite an interesting construction has been adopted in the building of a viaduct over the canal bridge of the Anhalter road and the Landwehr Canal, shown in Fig. 5. It was necessary to build a large iron bridge 8 m in width, having a 78-m span on special construction. Structural ironwork was erected 1.85 m above its supports, in order not to interfere with the railway traffic, and after the girders had been constructed they had to be lowered on to the supports. For this reason the bridge was supported at each of its four corners on three hydraulic presses, which had a total carrying capacity of 144 atmospheres. Clearing the structure was done in such a way that the pressure of all the twelve hydraulic presses was reduced simultaneously, which was essential, in view of the fact that the structure weighed about 40,000 kg. Each operation lowered the bridge 12 mm. The builders had to contend with a large number of difficulties, in spite of which the work was done in four days without the slightest accident. The height of the structure above the surface of the water is 15 m.

FIGS. 6-9.—VIADUCTS AND STATIONS

That portion of the road starting from the switchback and leading to the Zoological Garden traverses for a length of 269 m the Potsdamer railway station. The construction is such as to permit a change of position of the railway tracks in case this is deemed advisable at a later date. Fig. 7 shows the Oberbaun Bridge, 146 m in length, over which the elevated road passes the River Spree. On this bridge the tracks run on an arcade-like structure, which harmonizes in every way with the bridge structure itself. The

building of this portion of the road the city undertook for the round sum of M. 170,000.

One of the most interesting portions of the entire elevated structure is the triangular switchback above referred to. A very interesting problem has been solved here, and it may be worth while to give some of the details.

It is proposed to so arrange the running schedule of the road that trains can run back and forth from west to north and north to east and west to east. The switchback is so constructed, being double tracked throughout, as to permit such an arrangement. Perhaps the most interesting feature of the switchback is the fact that there is absolutely no crossing of tracks. The plan was proposed by the well known engineer, Kemmann, and was executed by Siemens & Halske, to whom great credit is due. After its completion it will be difficult to find a place of vantage from which it will be an easy matter to distinguish the mixed network of viaducts, bridges, etc., which form the structure. There are no steeper grades than 1.38, and no curves on double tracks having radii less than 95 m.

The average distance between the thirteen stations, ten of which are intended for the elevated road and three for the underground road, is 930 m. The shortest distance is only 340 m, and is between the stations Stralauer Thor and Warschauerbrücke, and the greatest distance, 1940 m, is between the stations Potsdamerstrasser and Potsdamer Platz. This great length is accounted for by the fact that the road has to pass over the enclosure of the Potsdamer railway station.

The architecture of the stations is comparatively simple. Most of the stations are located along the center of broad streets, and are so built that the traffic beneath is unobstructed. The sub-structure harmonizes in every way with the adjoining viaducts, that is, it is supported by two rows of wrought-iron pillars and cross-beams on which the tracks are laid. A number of the stations resemble that at the Görlitzer railway station, shown in Fig. 9. Two of the stations differ from the last named by being accessible through buildings, as shown in Fig. 10, instead of steps. The platforms are 3 m in width, and are located similarly to those on the Liverpool Electric Elevated Road, on each side of the elevated structure. As seen in Fig. 9, the width of the structure is 11.5 m, and is covered for a distance of 50 m by a flat sheet-iron roof,

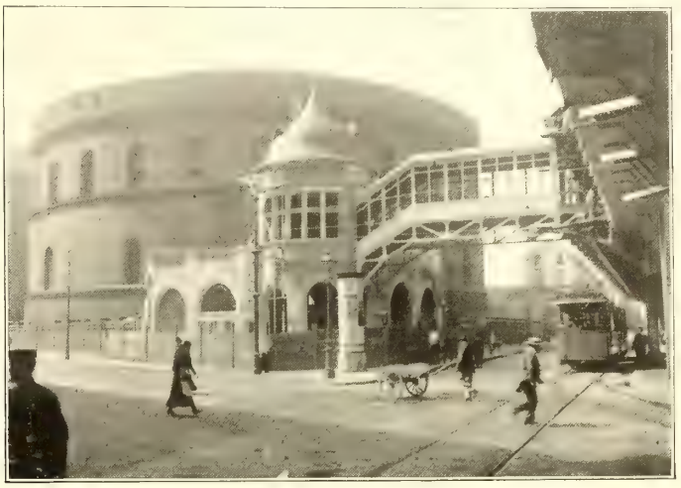


FIG. 10.—ENTRANCE TO THE PRINCESSENSTRASSE STATION

while the remaining 30 m remain uncovered. The height of the platform above the top of the rail is 85 cm, and it is 6.15 m above the level of the street.

Several of the depots, on account of their location, demanded a more elaborate architectural construction. Fig. 11 shows a southeast view of the depot at the Schlesisches Thor. The difficult problem presented here was successfully solved by the architects Gresebach and Dincklage, to whom the commission was given by Siemens & Halske. As will be seen in Fig. 12, the stairway approach on the one side is balanced by a spacious waiting-room on the other. A portion of the structure is fitted up as a restaurant, and another portion for stores. The former is connected with the upper waiting-room by means of a winding stairway, for the reception of which a tower has been built.

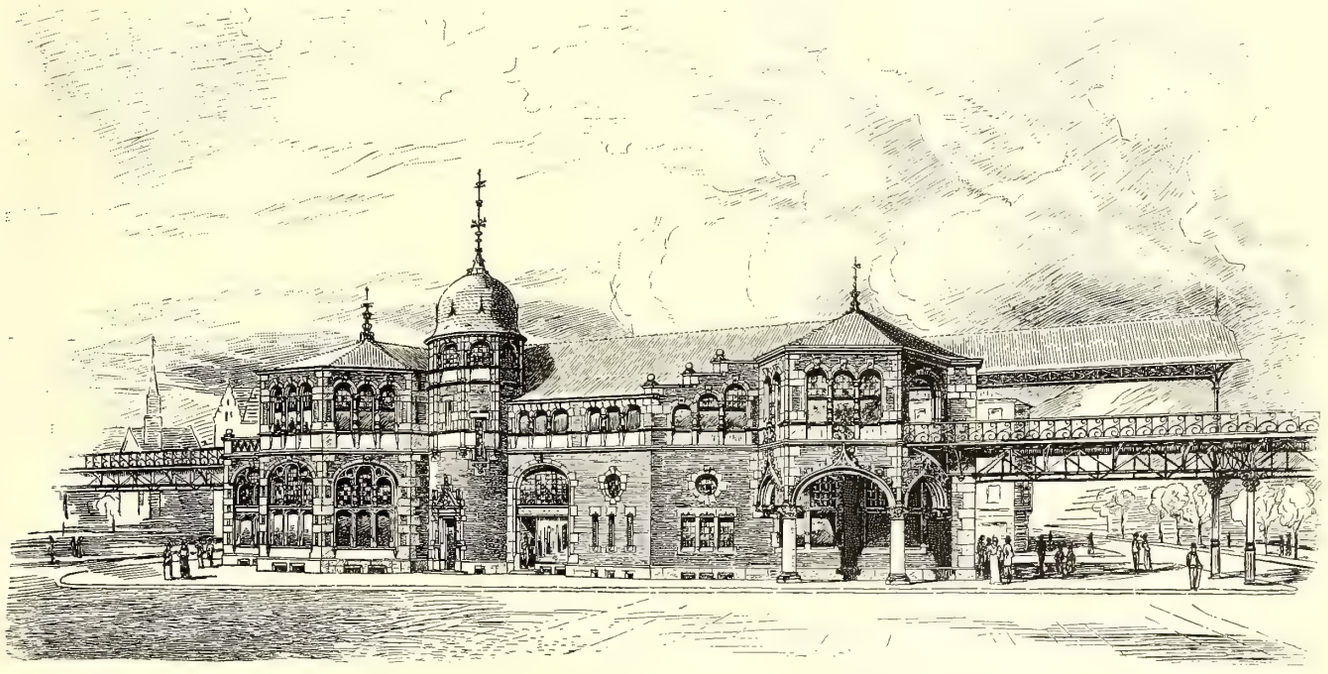
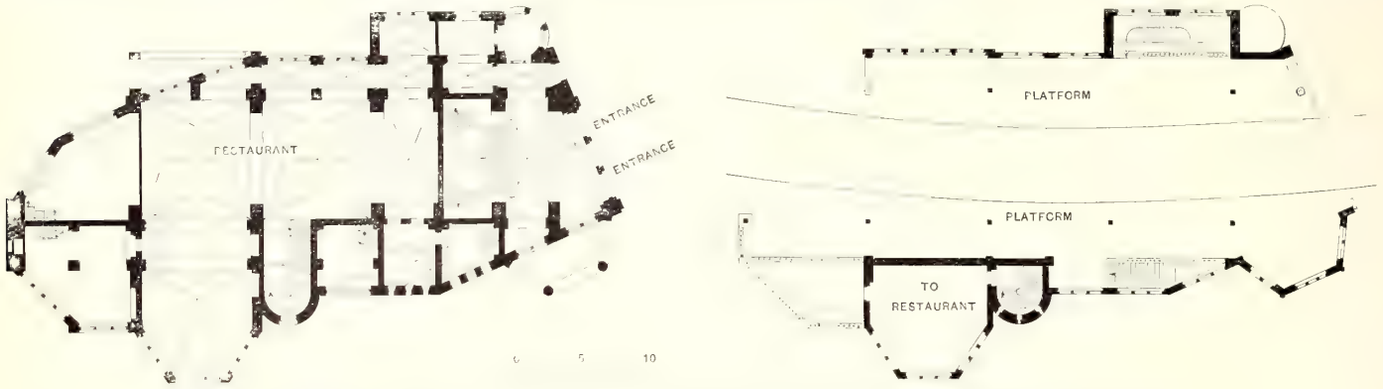


FIG. 11.—SOUTHEASTERN VIEW OF STATION AT SCHLESISCHES THOR

The largest station will be that at the terminal at the Warschauer Bridge. It is 300 m in length and 26.5 m in width. One-half of this length is in the form of a curved viaduct; the other is an iron viaduct on stone pillars. Besides the depot, which is 50 m in length and is situated on the viaduct with its three platforms each 80 m in length, a car house will be built at this point, in which twelve trains, each 45 m in length, may be stored. There is also a carpenter and varnishing shop on the viaduct. In the lower portion are located the other workshops, to which the cars to be repaired are sent by means of electric elevators. The remainder of the viaduct arches will be let out for storage purposes.



FIGS. 12 AND 13.—PLAN OF GROUND AND SECOND STORIES, SCHLESISCHES THOR STATION

Fig. 14 shows the proposed depot at the Nollendorf Platz. The viaduct leads from Bulowa Strasse to the railway depot, which is a light structure built on sandstone pillars. The whole is surmounted by a cupola, which forms the central point of a square. Close behind the station the road begins to descend. On the other side of the square the structure is flanked by obelisks, which correspond to the parklike surroundings.

FIG. 14.—PROPOSED DEPOT AT NOLLENDORF PLATZ

The building of the underground portion of the road was begun but recently, and for that reason we are not in a position to present any illustrations of this part of the undertaking. As will be seen from the plan, there will be two depots, one at the Wittenberg Platz and the other, the temporary terminal station, at the Zoological Gardens. This latter station will adjoin the present station of the city belt line, and for this purpose the Hardenbergstrasse will be widened from 17 m to 43 m. These stations are reached by means of stairways which are flanked by simple balustrades. These approaches have the advantage of great ease in reaching the station, as the stairs are only 3.5 m in depth. The underground stations are handsomely equipped. Cream-colored porcelain slabs cover the walls and ceiling. As the stair shafts are uncovered they also serve as ventilators for the tunnel.

The total height of the tunnel above the rails is 3.3 m. Through the center there will be a row of supports .25 m in width. On each side of this row there will be a space of 35 m, then the width of each side of the car itself, which is 2.3 m, and between this and the walls of the tunnel 3.5 m more, making the total width from wall to wall equal to $(2 \times 2.3) + (4 \times .35) + .25 = 6.25$ m. At the curves the tunnel must, of course, be somewhat wider. The tunnel will be constructed of cement, and the 1-m walls and bed are made water-tight by means of asphalt felting. Above the cement bed a brick layer will be built, which contains a water drain. This roof is composed of iron beams, which rest on the cement walls 1 m apart. Between these beams cement arches will be constructed similar to those in Buda-Pest. These arches are leveled off on top by means of a layer of cement, above which is laid a water-tight covering of asphalt felting. Above this the pavement is laid.

The tunnel is built during the day in those streets only where the traffic permits it. In other streets the walls are built separately during the daytime, and the core of the tunnel is removed from the end. According to the municipal regulations, the tunnel covering must be built at night in streets where traffic is heavy, and the latter must be provided for during the day by a temporary wooden street surface. That part of the tunnel lying behind the Köthenerstrasse, which is 344 m in length, is now in course of construction. After crossing the Landwehrkanal the road passes through the yards behind the western row of houses in the Köthenerstrasse. It is intended that be-

ginning at this point the underground road will some day be continued into the city, and for this purpose all the houses on the line of route have been purchased by the company.

The rails used are 115 mm in height and weigh 28 kg per meter. The so-called "Blättstoss" is used to connect the separate rails. Where the rails are laid from girder to girder without the use of sleepers they are 180 mm in height and weigh 43 kg per meter, as they will be unsupported for 1.5 m. The rails are thoroughly insulated from the iron structure by hard wooden blocks, which are laid beneath the rails. Between the wooden blocks and the rails layers of felt are placed.

The conductors at present consist of bare steel rails, which are located at the center of the tracks. A wedge-shaped shoe is pressed against these rails by means of springs.

There are at present forty-two motor cars and twenty-one trailers. The cars rest on two two-axle trucks. The cars are fitted out with longitudinal seats, like the West Side cars in Chicago. The motor cars will seat forty and the trailers sixty passengers, so that a train consisting of two motor cars and one trailer between them will seat 140 passengers. The total weight on one motor axle is calculated not to exceed 6 tons, while the weight on the running axle is from 4 tons to 4½ tons. The wheels on the motor axle are .9 m and those on the running axle .75 m in diameter. The distance between the wheels of the truck is 2 m. The car body is 2.3 m in width, about 13 m in length, and has a height of 2.18 m. Although it is proposed to use magnetic brakes, a hand-brake is provided, and in extreme cases a short-circuit brake may be used.

It is intended that the trains should have a headway of five minutes, which, in accordance with an agreement with the city of Berlin, may be extended to ten minutes during some specially designated hours when traffic is not very great. This headway will probably be decreased soon.

The extensive power house, which has been designed by the director of the company, Mr. Wittig, is partially completed, as shown in Fig. 17, and the equipment of the same has been begun. The lower part of the building will be the engine room, which contains three steam engines, each having a normal capacity of 900 effective horse-power and a speed of 115 r. p. m. There are, further, three direct-current dynamos, each having a capacity of 800 kw, and the necessary accessories. The dynamos are directly connected

FIG. 15.—GENERAL VIEW OF ELEVATED STRUCTURE, WITH TEMPORARY TRACK FOR TRANSPORTING MATERIAL ABOVE

to the engines. On the next floor six water-tube boilers are located, furnished by the Gehre Company, each having a total heating surface of 234 sq. m. The boilers have a superheating pressure of 10 atmospheres and an hourly capacity each of 3200 kg. Above the boilers the coal is stored in large sheet-iron funnels, from which the coal is fed automatically to the boilers. They are supplied with coal from canal-boats by means of Hunt conveyors. The engines and boilers are being installed at present. The feed-water is obtained from the Landwehr Canal, and is led to the station by a pipe .75 m in diameter, and, as the same is located 1.5 m below the level of the ground-water, a suction plant had to be installed, so as to lower the ground-water level 2 m. After the water has been used the oil is extracted from it and it is led back into the canal by an .8-in. pipe. The chimney is 80 m high, 7 m higher than the highest building in Berlin—the City Hall.

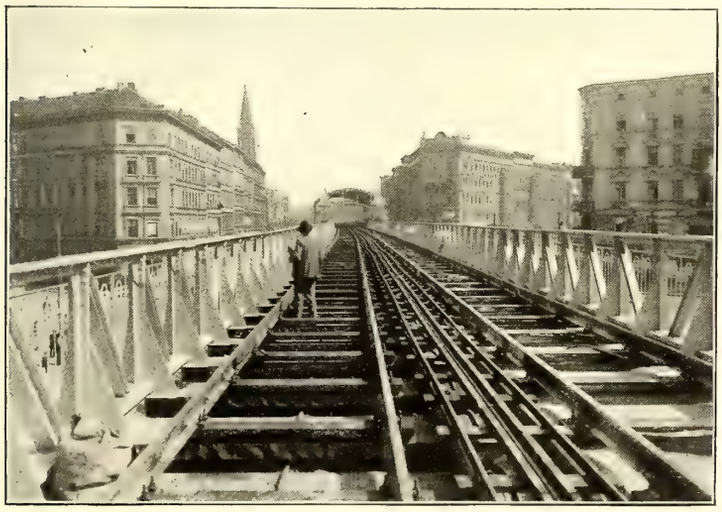


FIG. 16.—VIEW OF STRUCTURE WITH TEMPORARY TRACK FOR WORK TRAINS

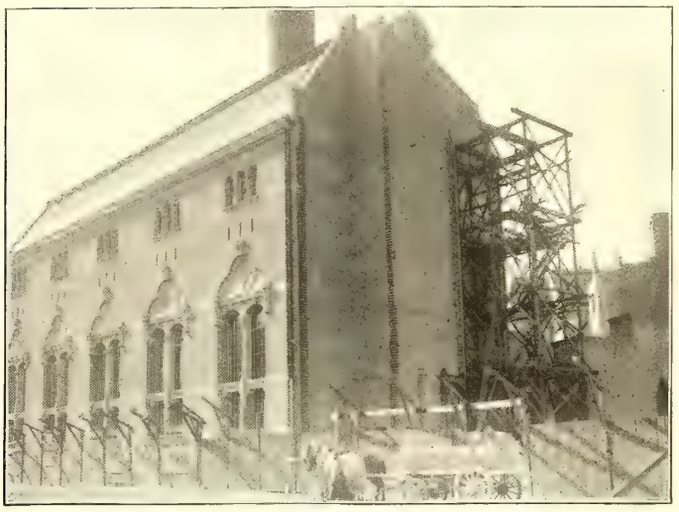


FIG. 17.—VIEW OF POWER STATION WITH SCAFFOLDING FOR ERECTION OF BOILERS

THE ELECTRIC TRAMWAY SYSTEM OF CARLISLE, ENGLAND

The rapidity with which the idea of municipal ownership and operation of tramway properties has developed in Great Britain since the introduction of electric traction has left only a limited field in this direction for the application of private enterprise. Practically all the larger corporations, excepting Dublin and Bristol, have in hand, or are committed to, schemes for municipal control of the tramway undertakings within their own borders, and in many cases considerably beyond them. Keeping in view the magnificent earning power of an electric tramway in any large center of population, it is not unlikely that even with the drawbacks incident to municipal control these undertakings in large cities will prove to be exceedingly remunerative. It is quite a different matter, however, where we have to consider towns of less than 100,000 inhabitants, and especially where the population falls below 50,000. American experience has shown that a satisfactory financial outcome in such small cities is almost altogether a matter of good equipment without extravagant initial outlay, and with careful and economical subsequent management. That with these two essentials success is more likely to be obtained from private than municipal control is a contention which very few will venture to gainsay. The Carlisle electric tramways, which are about to be described, afford an interesting example of a company undertaking, under British conditions, the operation of a street railway in a small city, in which all the conditions leading to success have been observed, and where the results are, from a financial point of view, correspondingly satisfactory.

SIDE AND CENTER POLE CONSTRUCTION

CAR HOUSE

LONG BRACKET POLE AT TURNOUT

The city of Carlisle is an interesting and historical English town, situated upon the Scottish border, and the scene of many a stirring event in the early history of what is now the United Kingdom. It has a population of from 40,000

to 50,000, and from the way it is laid out is what can be called a good tramway town. The City of Carlisle Tramways Company, after obtaining the necessary concessions, commenced work in September, 1899. The plans and specifications of the undertaking were prepared by the consulting engineers of the company, Alfred Dickinson & Company, of Birmingham.

The whole work was practically completed by the end of July, 1900. The total length of the various routes is 5½ miles, of which 3¼ miles are single track, the total track mileage being therefore 7¾ miles. A condition of the company's agreement with the corporation was that it should take current from the municipal electricity works upon the basis of 2d. per unit for the first 50,000 B. O. T. units (kw-hours), 1¾d. per unit for the next 100,000 units, and above 150,000 units 1½d. per unit. The tramway company at the same time guaranteed to pay the corporation for a minimum consumption of 100,000 units per annum. It will be seen at once that this combined source of supply of current for lighting and traction affords to the corporation a very good market for a considerable and steady output during the entire year, and that at the same time the tramway company is saved the expenditure of capital required for the installation of the necessary power station. At the same time the price it agrees to pay for its current is perhaps not more than its cost from an independent installation of its own.

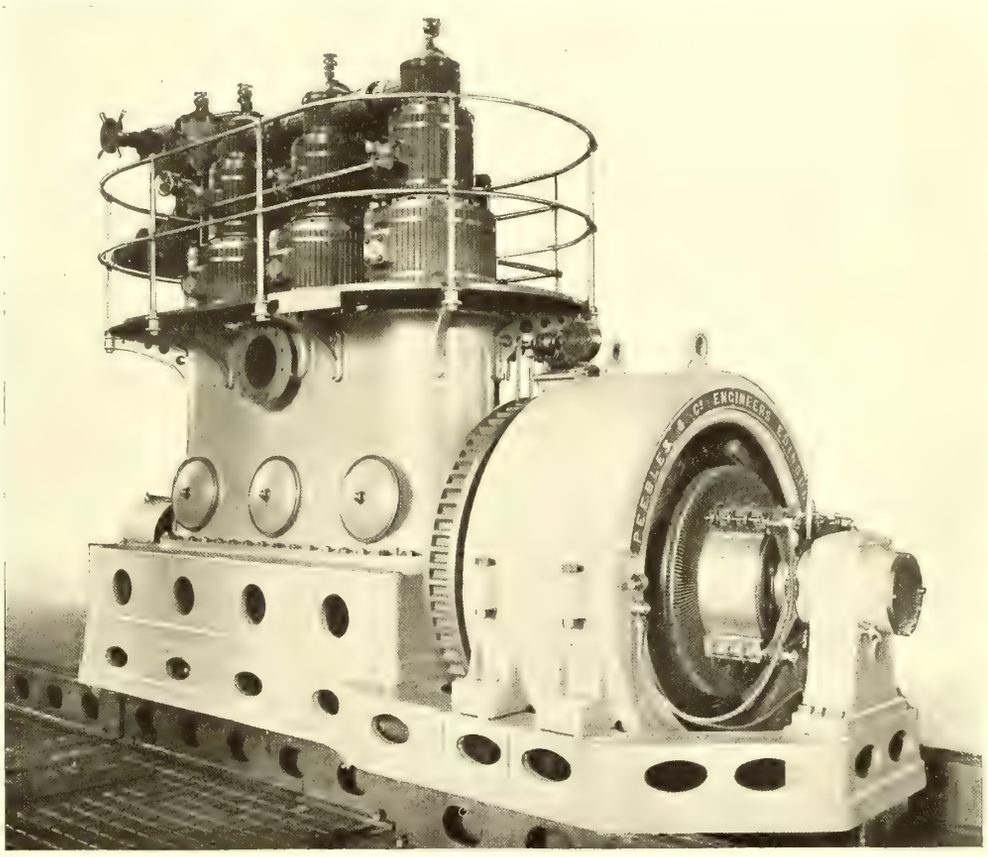
The contract for the whole of the work embraced in the equipment of the undertaking, including permanent way and overhead and feeder construction, and the furnishing of the necessary electric motor cars, etc., was placed in the hands of Dick, Kerr & Company, Ltd., London, and it is certainly indicative of the satisfactory results attending the English practice of placing the whole of such an undertaking in the hands of one competent firm of contractors that the work should have been completed in so short a time.

PERMANENT WAY

In the 7¾ miles of permanent way constructed no important grades occurred, the most considerable being one of 1 in 14 for a distance of about 60 yards. The curves, however, are fairly numerous, the radius of the sharpest being 40 ft. The narrowest width of street on the system is 14 ft. 6 ins. The line passes over three river bridges and under seven railway bridges, the lowest of which is 12 ft. 11 ins. above the rails, so that on this section single-deck cars only can be used. The gage of the track is 3 ft. 6 ins., laid with girder rails, weighing 83 lbs. to the yard. The fish-plates are of steel, 2 ft. long, and weighing 50 lbs. per pair, embodying the method of fish-plate construction known as the "Dicker" patent joint. The rails are bonded with double Neptune bonds, no cross bonding being used. All the special track work, consisting of junctions, etc., was manufactured by Dick, Kerr & Co. at their works at Kilmarnock, Scotland. The rails are laid on a foundation of 6 ins. of cement concrete, extending 2 ft. outside the rails, and the paving consists of whinstone and granite setts.

OVERHEAD EQUIPMENT

As will be seen by the illustrations, the overhead construction is carried out generally upon the lines which are familiar in America, but with that greater attention to detail and appearance which makes overhead construction in Great Britain distinctly tasteful. Side-pole construction is principally used, though a small amount of center-pole work has been found necessary. The Dickinson side-running trolley, with side-pole construction, is used. The poles are of steel, drawn taper, 28 ft. to 30 ft. in length, the diameter at the base being 7 ins. The bracket construction departs from the usual English practice, in the fact that cast iron is used. The result, while giving an ample margin of mechanical strength, has rendered possible a very ornamental and artistic design, which is exceedingly handsome in appearance. The feeder system is exceedingly complete. The cables are insulated with vulcanized bitumen, protected by double braiding of hemp yarn, and are of the drawn-in type, laid in Sykes patent conduits. The usual feeder pillars are arranged at half-mile intervals, each terminus being in telephonic communication with the power station.



ENGINE AND GENERATOR SET

ROLLING STOCK

The rolling stock consists of twelve four-wheel motor

cars, of which nine are of the double-deck and three of the single-deck type. The bodies were built for Dick, Kerr & Company by the Electric Railway & Tramway Carriage Works, of Preston, and are mounted on Brill 21-E trucks. all, have a seating capacity of twenty-two passengers.

GENERATING UNITS

A view of one of the generating units is given on the previous page. It consists of a 300-kw Peebles generator,

PASSING UNDER LOW BRIDGE

INTERIOR OF CAR HOUSE

VIEW OF ONE OF THE FIRST CARS

The electrical equipments are of Dick, Kerr & Company's standard type, with solenoid blow-out controllers. The length over all of the double-deck cars is 26 ft. 6 ins., and their seating capacity is forty-three passengers. The single-deck cars, which are of the same length over which is direct-connected to a Willans' 3-A 450-hp engine, running at 340 r. p. m. This set is capable of running from no load to 25 per cent overload without sparking. The combined efficiency of the plant is 85 per cent. Two of these sets are installed.

AMERICAN ENGINEERS AND TRAMWAY MANAGERS ABROAD

It is a well known fact that a large portion of the electric tramways now being installed in different parts of the world outside of the United States are sending to America for their supplies, and are largely following American methods in construction. It may not be equally as well known, however, that a large part of this work is being done under the supervision of American engineers. This need not be surprising, however. Whatever may be the condition a few years hence, it is only reasonable to expect that the country in which the greatest development in electric railway construction has taken place should be the field where the widest experience in the railway construction should be secured, and that consequently America has been the point to which foreign capitalists have looked for engineers when engaging in tramway construction. It has not been only to assist in building roads, however, that American railway engineers have taken up their residence abroad. Many have gone to Europe to engage in the manufacture of electrical apparatus in branches of parent manufacturing companies in America; the services of still another considerable number have been secured by foreign manufacturing companies to carry on abroad the manufacture of apparatus after American patterns and ideas. The reasons for this are natural. If the development of American electrical apparatus abroad has been in advance of that of other countries, the cause must lie in the greater experience and consequent skill of the men who produce the article, so that it has been only reasonable that those who wished to meet American competition should desire the services of American experts in the different lines.

The list of American street railway managers and superintendents whose services have been engaged for operating electric roads abroad is also a lengthy one, for it is only reasonable to suppose that a road using imported apparatus could best be operated, at first at any rate, by those whose experience has made them familiar with the working of the machinery used. Moreover, American operating methods are looked upon with the highest respect by foreign owners; the proverbial push and business energy of the American manager have won great respect, and their services are eagerly sought for in all parts of the globe. Still other Americans, seeing the possibilities of electric railway operation abroad, have crossed the water to purchase and equip systems in cities where the nearer capitalists failed to recognize the financial possibilities offered, and in this way have secured control of important tramway systems.

While it would be impossible to mention all of those tramway men who, for business reasons, have taken up their residence outside this country, it may not be amiss to refer to some of them as showing the influence exerted in tramway affairs the world over by Americans.

In Great Britain, the American tramway colony has now reached considerable proportions. The pioneer was undoubtedly R. W. Blackwell, who, in 1889, settled in London to engage in the sale of American electrical apparatus. Previous to this time Mr. Blackwell had taken a prominent part in the development of the electrical lighting and railway industries of America, and in 1884 to 1889 was president of the Bentley-Knight Electric Railway Company, which was one of the strong pioneers in the field of electric traction. After taking up his residence in London, Mr. Blackwell, for a number of years, acted as European representative for prominent American manufacturers, and in addition carried on a business as contractor for electric railway, power and lighting systems. In this work Mr. Blackwell was eminently successful. Early in 1899 he merged his entire business into the limited corporation of R. W. Blackwell & Company, with strong financial backing, which puts his company in the front rank of the electrical industries. The next electrical engineer to take up an English residence was probably Horace F. Parshall, the well known consulting engineer. Mr. Parshall had also been one of the pioneers in the electric railway development, and had designed some of the early electric motors which had proved most successful. His engineering work with the Sprague Electric Railway & Motor Company, and later with the General Electric Company, stamped him as one of the leading designers of electric railway apparatus, so that when a strong engineer was desired during the early nineties for the British Thomson-Houston Company, Mr. Parshall was selected. During the last few years Mr. Parshall has acted as an independent consulting engineer in London, and has achieved a most successful record. The largest transportation plants in the country have been placed unreservedly in his hands, and his authority on all matters pertaining to the engineering of electric railroading is unquestioned. Two other engineers, who have also enjoyed a large degree of success, are J. F. Macartney and J. A. McElroy, of Macartney, McElroy & Company. Mr. Macartney was the first to take up his residence in England, and found so much demand for electric railway engineers and contractors that he was soon joined by his partner. These gentlemen had previously been well known in America as successful electric railway contractors, and have carried through a number of the important installations in England and Scotland.

As announced recently, the new British firm of J. G. White & Company, Ltd., is another organization with American connections which has entered the field as consulting and contracting engineers under the most favorable auspices. The new company has been organized with J. G. White as chairman of its board; O. H. Baldwin, as managing director, and A. N. Connett and E. P. Jones, as chief engineer and mechanical engineer respectively. While Mr. White is an engineer of recognized ability, he is also an experienced business man and his selection as chairman is a most fitting one. It is sufficient to say of him that he is probably the best known and most successful engineer and builder of electric railways in America. Mr.

Connett is generally regarded as one of the leading authorities, if not the leading, on the construction of underground conduit electric railways. Having a brilliant record in America as an engineer of cable and electric conduit railways in New York, Baltimore and Washington, Mr. Connett took up a Paris residence and became chief engineer of the French Thomson-Houston Company. While in this capacity he installed a number of important French tramways on the trolley, underground and surface contact systems, and, becoming very conversant with French conditions, as he was with American methods, was able to make such modifications of the latter as to suit the circumstances as he found them. Mr. Connett was individually awarded a gold medal at the recent Paris Exposition in recognition of his ability in trolley road construction, and his connection with J. G. White & Company, Ltd., adds great strength to that company. Mr. Baldwin, whose long experience and extensive acquaintance with British requirements makes him an exceptionally strong man for the position, is the managing director. His electrical experience was secured first with the Westinghouse Electric & Manufacturing Company, and later with the Westinghouse Electric Company, Ltd., of London, of which, in 1892, he was appointed chief engineer, and in 1894 managing director. Mr. Jones is a mechanical engineer of high reputation in America, having been for a number of years connected with the Union Iron Works and the Risdon Iron Works, both of San Francisco. One of the resident directors of the J. G. White Company, Ltd., is Edward B. Wyman, who is also interested in a number of electrical tramway undertakings abroad, particularly in Australia. Mr. Wyman is also an American, having lived for a long time at Niagara Falls. He was for a number of years the New York representative of the Central Electric Heating Corporation, and in this capacity acquired an extensive acquaintance in the street railway field.

Among the Americans to take up their residence in London recently are W. J. Clark and E. H. Johnson. Mr. Clark, as general manager of the railway department of the General Electric Company, for a long time occupied a prominent position in the tramway affairs of this country. His experience in electric railroading dates back to the early days, and the important pioneer work of the original Thomson-Houston Company was due largely to his personal efforts. Mr. Clark is not only an engineer, but has paid a great deal of attention to the broader questions of electric railroading, and is authority on manufacturing and street railway finances. He is equally conversant with foreign railway and commercial conditions, and to this expert knowledge was largely due his selection to take charge of the entire foreign business of the General Electric Company. E. H. Johnson, although only recently a London resident, has passed much of his time during the last ten years in England, and his name is a familiar one in London financial and electrical circles. For a long time president of the original Edison Company, Mr. Johnson was the first to introduce the Edison incandescent lamp to the English public. Although recently he has interested himself more particularly in the financial end of electrical enterprises, Mr. Johnson is also an inventor of note, and has patented many important devices in different branches of the electrical industry. His recent residence in London is due to his connection with the formation of the Johnson-Lundell Electric Traction Company, Ltd., in the promotion of which he is meeting with great success. Another General Electric man to make headquarters in London is A. K. Baylor. Mr. Baylor made a host of friends in this country while a member of the railway department of the General Electric Company, and his original commission abroad was to occupy the position of general manager of the railway department of the British Thomson-Houston Company, in which position he was very successful up to the time of his resignation to open an office as an independent engineer. Mr. Baylor is now interested in several financial syndicates operating tramway properties in Great Britain and elsewhere, and enjoys to a marked degree the confidence of the leading street railway men of Great Britain.

An English company to secure a large number of Americans in the engineering department is the English Electric Manufacturing Company, Ltd., of Preston. The technical director of these important works is Prof. S. H. Short, recently of the Walker Company, of Cleveland, Ohio, and formerly the head of the Short Electric Railway Company. These works, which have recently been completed, are built largely after the best American models, and are equipped throughout with the most modern and up-to-date machinery which the American builders could furnish. Prof. Short's work in America is too well known to need further description, and there is no reason to doubt that he will achieve success abroad in the construction of apparatus for electric railway service, as he did in this country. The company is now employing about 1000 men, and the output of the works is now from five to six equipments per day. Adjoining the works of the English Electric Manufacturing Company at Preston, and in close business connection with this, is the plant of the Electric Railway & Tramway Carriage Works, Ltd., the leading street railway car builders of Great Britain, in charge of E. A. Stanley, also an American. Mr. Stanley went to Preston from the car shops of the Jackson & Sharp Company, of Wilmington, Del., and is a well known authority on car building and construction. Under his able management the company's cars are now running on many of the English tramways, although the works have been in operation for only a short time. The superintendent of the works is Mr. Angerer, formerly of the Gilbert Car Manufacturing Company, of Troy, N. Y. These works employ about 500 to 600 men, and are turning out three cars a day. Closely allied with the English Electric Manufacturing Company, Ltd., and the Electric Railway & Tramway Carriage Works, is the firm of Dick, Kerr & Company, engineers and railway builders, the leading firm of its kind in Great Britain. The entrance of this company into the electric railway field was announced some time ago, and it is not surprising that an American should be found in charge of its railway department. This gentleman is F. C. Armstrong, who went to London from Toronto, Canada, resigning the position of chief engineer of the Canadian General Electric Company. Mr. Armstrong is now well known on both sides of the Atlantic, and under his supervision a number of the most important roads in Great Britain have been electrically equipped.

Another prominent manufacturing company to be represented abroad is the J. G. Brill Company, whose foreign business has reached large proportions. Its London representative is M. E. Curwen. Mr. Curwen has spent

so much time abroad that he is fully conversant with British conditions, and has done much to advance the interests of the Brill Company in Europe.

Another American electrical engineer abroad is A. C. Shaw, manager of the STREET RAILWAY JOURNAL in Great Britain and Europe. Mr. Shaw, though Scotch by birth, has spent the greater part of his professional career in America, and is well known as a newspaper man and an able writer on electrical subjects. He was for many years manager of the *Electrical Engineer,* of New York, but for some time past has been the European manager of the STREET RAILWAY JOURNAL. His headquarters are in London.

Connected with the Westinghouse interests in Great Britain are several well known Americans. This is true not only in the engineering, but in the business department as well. In the former are found W. W. Blunt, E. N. Sautelle, M. Maclaren and H. M. Southgate. Mr. Blunt is a graduate of Lehigh University. After spending several years in the service of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, he was selected for an important position with the British company. He has been in London for the past three or four years. Mr. Sautelle is also a graduate of Lehigh, and served with distinction as an electrical engineer in the government service during the Spanish war. He has been in London for about a year and a half. Mr. Maclaren is a graduate of Princeton, and has been in London for two and a half years. Mr. Southgate is a graduate of the Worcester Polytechnic Institute, and while in Pittsburgh was connected with the laboratory and engineering department of the Westinghouse Electric & Manufacturing Company.

Prominent in the business department of the Westinghouse interests is Arthur Warren, who can also be considered a resident of London, as he spends very much of his time in that city. Mr. Warren, who is at the head of the publishing department of the Westinghouse companies, has had a brilliant career as author and newspaper writer, having been for a number of years the London correspondent of the Boston *Herald*, and essays and criticisms from his pen have appeared in many magazines and attracted widespread attention. His recent work in London has been in connection with the organization and other important developments of the Westinghouse interests abroad.

Among the street railway managers to be found in London is Granville C. Cuningham, manager of the Central London Underground Railway Company. Mr. Cuningham is well and favorably known among the street railway managers in this country, having for a long time been general manager of the Montreal Street Railway system. The system now under his charge is the most important of the underground roads in London, and that he should have been selected to control its interests is the highest testimonial which could be given to his ability and training as a railway manager.

While the above list by no means includes all of the Americans who are occupying prominent and responsible positions in British tramway affairs, the space at the disposal of this article compels a stop here to cast a brief and equally cursory glance over Continental affairs.

This immediately calls attention to the fact that some of the most important electric work on the Continent is being conducted by a syndicate of which Stephen D. Field is the chief engineer. The place of Mr. Field's latest operations is in the neighborhood of Geneva, Switzerland, where, as described in a recent issue of the STREET RAILWAY JOURNAL, the entire tramway system, consisting formerly of several small roads, has been consolidated and electrically equipped, while important extensions are contemplated. Mr. Field was the builder of the "Judge," the first locomotive in the United States, and has always occupied a prominent position in electric railway matters in this country. Associated with him in his work is Richard McCulloch, formerly chief engineer of the Cass Avenue & Fair Grounds Railway Company, of St. Louis, and son of Captain Robert McCulloch, general manager of the Chicago City Railway Company. Although a young man, Richard McCulloch has acquired a wide experience in electric traction service, and is an excellent representative of the young American electrical engineer abroad. Quite recently also Mr. Field's staff has had an accession in his son, Dudley Field, lately of the electrical engineering corps of the New York Telephone Company.

Germany, which has always been a leader in electric railroading, has not had as much need to call on American talent in this direction as some other countries. It is notable, however, that the manager of one of the largest electric manufacturing companies in Germany, the Union Elektricitäts-Gesellschaft, is an American. This gentleman, Louis J. Magee, is a graduate of Wesleyan University, Middletown, Conn., entered the electric works of the Thomson-Houston Company at Lynn in 1885, and installed a number of electrical plants in New England and elsewhere. Later he spent a year and a half in electrical work in Lima, Peru. From that time on Mr. Magee's work has been chiefly in foreign countries. In 1888 he was appointed in charge of the engineering office of the Thomson-Houston Company in Hamburg, and in 1892, on the organization of the Union Elektricitäts-Gesellschaft, he was appointed its manager. Under Mr. Magee's direction, the company has done a large amount of electric railway construction, and had great success in the manufacture of electric railway apparatus and electrical apparatus for power transmission.

One of the first Americans to see the possibilities in the electric railway industry in France was Charles LeBlanc, who gained his experience in electric railroading with the Sprague Electric Railway & Motor Company, of New York City, but about ten years ago went to Paris, where he has been very successful in the organization of tramway companies and in the equipment of electric tramways. Mr. LeBlanc has made several trips to America since he took up his residence in Paris, and has been a close student of American electric railway methods.

The Société Industrielle d'Electricité Procédés Westinghouse, the French Westinghouse Company, is also largely conducted by Americans. The "sous directeur" of the company is Maurice Coster, who, though born in Holland, is in every practical sense an American. Mr. Coster is a graduate of Stevens Institute of Technology, and spent the active part of his life in this country until his services were secured by the Westinghouse Company in establishing its French branch. Mr. Coster has done a great deal to help advance the Westinghouse interests in France, and his latest and most important contract is that for the equipment of the Metropolitan Underground Electric Railway in Paris, which was brought to a most successful conclu-

sion, and is one which reflects great credit upon the Westinghouse Company. The managing director of the company is Mr. Albert Schmid, a resident of Havre, the location of the company's factory. Mr. Schmid, although a native of Switzerland, received his practical electrical education in this country, having come to America in 1882. During the greater part of his time while in America he was connected with the Westinghouse interests, first with the Air Brake Company and later with the Electric & Manufacturing Company. Associated with Mr. Schmid are H. L. Kirker, W. E. Reed, H. U. Hart and C. P. Smith. Mr. Kirker is engineer in charge of the testing room of the Westinghouse Works in Havre, and is a graduate of the Ohio State University. Mr. Reed, the electrician of the Havre Works, is a graduate of the Massachusetts Institute of Technology, and received his practical training in the works of the Westinghouse Electric & Manufacturing Company, of Pittsburgh. Mr. Hart, who is also located at the Havre shops, is a Technology graduate, as is also C. P. Smith.

Another highly important firm in France is the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston, in which it is needless to say Americans are prominent. The managing director is Ernst Thurnauer, who, though European by birth, is an American by training. Mr. Thurnauer came to this country many years ago, and was a prominent member of the early engineering staff of the Thomson-Houston Company. By this company he was commissioned to install electric lighting plants in Europe, and was celebrated as having installed the lighting plant nearest the North Pole. The success which followed him in this work led to the establishment in France of the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston, which has been in his hands ever since its inception. Also connected with this company is A. S. Garfield, who is a member of a family well known in Thomson-Houston annals. He has been very actively engaged in tramway work in Europe for the last few years, and is also in charge of the publishing department of the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston, whose pamphlets on electric railway work are particularly complete and interesting.

Thus far, Europe only has been considered as a field of operation, but reference should be made to work of American engineers elsewhere. In South America, the Buenos-Aires tramway systems are largely in the hands of two Americans, Charles Bright and Theodore N. Vail. Although Mr. Bright has spent the greater part of the last twenty years abroad, he makes frequent visits to America, and believes in American methods of railway operation. Mr. Vail's name is familiar through his connection with the development of American electrical interests, particularly the telephone, and he now represents also a large amount of English and American capital. The electrical engineering work in the city has been largely in the hands of E. T. Birdsall, F. A. Wardlaw and P. A. Clisdell, all from America. The larger part of the electrical equipment of the lines in Rio de Janeiro, Brazil, has been carried out by James Mitchell, also an American. Mr. Mitchell was sent to Rio de Janeiro in 1890 by the Thomson-Houston Electric Company, after having installed electric railways in Des Moines, Omaha, Council Bluffs, Denver and other important points. Since he has been in Brazil, Mr. Mitchell has established a reputation of which anyone can be proud, being most influential with the government, having made a large fortune and having established at Rio de Janeiro one of the largest and handsomest electrical supply houses in any city. The electric tramway system of Sao Paulo, Brazil, was installed by and is in charge of R. C. Brown, formerly of Boston and later of Montreal, while that in San José, Costa Rica, Central America, is in charge of H. T. Purdy, formerly superintendent of the Georgetown & Tenallytown Railway, of Washington, D. C.

Much of the electrical work in the Republic of Mexico has been carried on by D. Mazanet, of New York. The management of the tramways of the City of Mexico was for a long time in the hands of H. P. Bradford, formerly of Cincinnati; and H. B. Niles, formerly of Indianapolis, still occupies an important position with the company. Mr. Bradford is now engaged as an expert by a London financial syndicate, and this business takes him all over the globe.

The West Indian Islands, formerly belonging to Spain, have, under their new political conditions, awakened to a period of industrial activity, in which tramway construction is a natural accompaniment. Thus, the extensive system of Havana, Cuba, is now being electrified under the direction of George F. Greenwood, formerly general manager of the Consolidated Traction Company, of Pittsburgh, and the tramway system of Ponce, Porto Rico, is being electrically equipped by John A. Wilson, of J. G. White & Company. Mr. Wilson has supervised the construction of a number of electric roads in the United States, notably the Niagara Falls & Buffalo Electric Railway.

In Australia, the general manager of the Brisbane Tramways is J. S. Badger. Mr. Badger was one of the early engineers of the Sprague Electric Railway & Motor Company, and installed a number of the first trolley railways in this country. Several years ago Mr. Badger was sent by the General Electric Company to carry on tramway construction in Australia. After finishing the Brisbane tramways, upon which he was engaged, he was appointed by the company manager of the system. Arthur Jones, who has also been largely instrumental in the development of electric railway matters in Australia, is a graduate of the Institute of Technology of Boston, and has spent the greater part of the last ten years in Australia. The tramway system of Perth was also built and is controlled by American capital. This system was equipped by W. E. Cooke, formerly chief engineer of the Peckham Truck Company, and until recently has been in charge of S. W. Childs, of New York.

In the Far East, Americans have been as prominent in tramway matters as in other parts of the globe. The Seoul Electric Railway Company, in Korea, is in the hands of H. R. Bostwick, formerly of San Francisco, and H. Raymond Crumm, of Columbus, Ohio, while in Japan are E. A. Carolan, formerly of New York, and the firm of Bagnall & Hilles. Both members of the latter firm are of Brush antecedents, and are in touch with all the important electric railway and light developments in that part of the world. Even in South Africa an American is found in charge of the principal tramways, *i. e.*, those in Cape Town and Port Elizabeth. This is John E. Lloyd, who was formerly connected with the Field Engineering Company, of New York, and in that capacity he assisted in the construction of the Buffalo Street Railway system and a number of other important electric railways in the early days.

TABLE SHOWING COST OF OPERATION FOR THE FIRST SEVEN MONTHS OF 1900 OF THE CENTRAL AVENUE POWER STATION OF THE METROPOLITAN STREET RAILWAY COMPANY, KANSAS CITY, MO.

	January 1900		February 1900		March 1900		April 1900		May 1900		June 1900		July 1900	
Output in kilowatt-hours	539,000 K. W. H.		572,187 K. W. H.		746,684 K. W. H.		812,789 K. W. H.		894,415 K. W. H.		878,604 K. W. H.		960,589 K. W. H.	
Cost of operating	Total Cost	Cost per K.W.H. cts	Total Cost	Cost per K.W.H. cts	Total Cost	Cost per K.W.H. cts	Total Cost	Cost per K.W.H. cts	Total Cost	Cost per K.W.H. cts	Total Cost	Cost per K.W.H. cts	Total Cost	Cost per K.W.H. cts
	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Engineers, firemen, oilers and other workmen	559.89	.001038	581.75	.001016	607.72	.000814	627.08	.000772	694.93	.000777	770.51	.000876	783.23	.000815
Repairs to engines and machinery	42.58	.000079	35.77	.000063	14.83	.000019	32.70	.000040	39.71	.000044	122.12	.000139	61.83	.000065
Oil and waste	8.10	.000015	71.85	.000126	42.09	.000056	56.33	.000069	69.88	.000078	48.03	.000054	115.77	.000121
Fuel	2,100.33	.003896	1,610.33	.002815	2,052.42	.002759	1,879.92	.002312	2,300.88	.002572	2,356.08	.002682	3,004.27	.003127
Water	66.29	.000124	66.53	.000115	59.90	.000090	53.10	.000065	42.77	.000048	46.12	.000053	49.26	.000052
Generator and switchboard attendance and rep's	103.53	.000193	98.84	.000173	59.99	.000091	29.79	.000037	139.97	.000156	102.85	.000117	117.79	.000122
Miscellaneous	51.45	.000095	4.00	.000007	.68	.000001	11.36	.000014	48	.000001	6.40	.000008	18.14	.000018
Total	2,932.17	.005440	2,469.07	.004315	2,837.63	.003830	2,690.28	.003309	3,288.62	.003676	3,452.11	.003929	4,150.29	.004320
	Total Quantity	Quantity per K.W.H	Total Quantity	Quantity per K.W.H	Total Quantity	Quantity per K.W.H	Total Quantity	Quantity per K.W.H	Total Quantity	Quantity per K.W.H	Total Quantity	Quantity per K.W.H	Total Quantity	Quantity per K.W.H
Coal, number of tons purchased	1,684[2] tons	6.23 lbs.	1,339[550] tons	4.68 lbs.	1,855[15] tons	4.8 lbs.	1,973[225] tons	4.85 lbs.	2,208[1050] tons	4.93 lbs.	1,857[25] tons	4 22 lbs.	2,250[3] tons	4.86 lbs.
Cylinder oil, number of gallons purchased	.... gals.	.. gls.	200[5] gls	3.5 gls.	152 gls.	2.3 gls.	151[5] gls.	1.86 gls	300 gls.	3.35 gls.	100 gls.	1.14 gls.	402[8] gls.	4.19 gls.
Engine oil, number of gallons purchased	.... gals.	.. gls.	300 gls.	5 24 gls.	.... gls.	.. gls.	95 gls.	1.17 gls.	152[5] gls.	1.7 gls.	200 gls.	2.27 gls.	250 gls.	2.6 gls.

CONDUIT CONVERSION IN WASHINGTON

WASHINGTON, D. C., Sept. 13, 1900.

EDITORS STREET RAILWAY JOURNAL:

An article on page 831 of the September JOURNAL recites that the Third Avenue Railroad, of New York, was changed from cable to conduit-electric while in operation as a cable road, and adds: "On the other hand, the Capital Traction Company, of Washington, D. C., in altering over its Pennsylvania Avenue cable line to electricity, ran horse cars during the interruption."

Be pleased to observe that horse cars were necessarily run during the conversion of the Pennsylvania Avenue and Fourteenth Street lines of the Capital Traction Company because the power station of those lines had been totally destroyed by fire, and indeed this loss was the very occasion of the change of power.

Note also that immediately after the completion of the lines named the Seventh Street road of the same company (which had a power house of its own) was converted from cable to conduit-electric "rapidly, safely and with the minimum obstruction of street traffic (and none whatever of cable railway traffic) during the regular operation of the road by cable;" and further that this performance in Washington was, in the belief of the writer, then without precedent, and certain it is that it was completed long before the work on the Third Avenue line of New York was begun.

E. SAXTON.

COST OF STATION OPERATION IN KANSAS CITY

Reference is made elsewhere in this issue to the cost of operation of the Central Avenue or Kaw River power station of the Metropolitan Street Railway Company, of Kansas City. The table in the adjoining column gives the detailed expenses, total and per kilowatt hour during the first seven months in 1900. As the supplies are charged to the month in which they are purchased, not when they are used, a slight difference in the items can be observed.

STREET CAR BUILDING

(Stephenson Practice)

BY CHARLES HENRY DAVIS, C. E.

IX.—Assembling—(Continued)

In the September issue of the STREET RAILWAY JOURNAL we gave the details of the platforms for our two standard cars, namely, the Boston (closed) and the Brooklyn (open). Tables Nos. 39 and 40 give respectively the details of cabinet work, trimmings, etc., for these standard cars, while Plates XI and XII illustrate the various parts. As in Tables Nos. 31, 32, 33, 34, 35, 36, 37 and 38, each distinct part of the cabinet work, trimmings, etc., is described, giving the material, the general dimensions, how made, on what tools and how assembled, all in consecutive order as each car is built in the shop. In using these tables they are to be read across the page, line by line, as in the case of any book. Letters in column 4 are the same abbreviations of woodwork and metal work as used on Plates I and II. These tables are given on the following pages.

TABLE No. 39

DETAIL OF CABINET WORK, TRIMMINGS, ETC., OF BOSTON CLOSED CAR, IN THE ORDER OF ASSEMBLING

(25 ft. Body; Car No. 2; Fig. 3; Plates I, XI. and XII.)

Consecutive Number	Quantity	Name of Piece	Details: Piece Number Plates I. and XI.	Details: Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate XI	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									The Cabinet Work, Trimmings, etc., are prepared during the assembling of the pieces already described, and after the platforms and platform-hoods are attached (*see Table No. 37 and Plate IV.*) they are put in place, adjusted and secured, much in the order of procedure here given, although in many cases several different pieces or parts are in hand at the same time. Fig. 525 on Plate XII. shows in position much of what is here described in detail, so that reference to it will often be useful	
234	168	**Floor-strips** (Not Ill.)	1064	Y. P.	..	.....	..	¾ in. x ¾ in.	Clearly shown in Plates I. and II., are laid on the floor and screwed down with 648 No. 10 x 1½ in. steel screws	Molding machine
235	..	**8 Ventilator side-sashes** (Fig. 409)	4001	C.	..	.....	..	.....	Next the corner-posts, with center mullions, adjustable to open and close, composed of:—	
235a	8	**Top-rails** (Fig. 415)	4003	C.	..	.....	..	2 ft. 4¼ in. x 1¼ in. x ¾ in.	All joints mortised, tenoned and glued, each having one edge rabbeted 7-16 in. x ¼ in. to receive the glass *Note.*—The lengths of tenoned rails do not include the tenons	Variety machine, end tenoner and hollow-chisel mortiser
236	8	**Bottom-rails** (Fig. 416)	4004	C.	..	.....	..	2 ft. 4¼ in. x 1½ in. x ¾ in.		
237	16	**Stiles** (Fig. 412)	4006	C.	..	.....	..	8¼ in. x 1¼ in. x ¾ in.		
238	8	**Mullions** (Fig. 411)	4005	C.	..	.....	..	5½ in. x 1¼ in. x ¾ in.		
239	16	**Ventilator sash-pivots** (Fig. 524)	4520	Bz.	..	.....	..	.....	Screwed to the sashes with 32 No. 5 x ⅝ in. bronze screws, the pivots being inserted in the ventilator side-posts	
240	4	**Ventilator sash-openers** (Fig. 497)	4519	Bz.	..	.....	..	.....	Screwed by the arms (a) to the top-rails of each pair of sashes with 24 No. 9 x 1¼ in. bronze screws, while the holding piece (b) in which the adjusting rod (c) slides is screwed to the ventilator bottom-rail facia (4104) Fig. 479 with 16 No. 10 x ⅝ bronze screws	
241	16	**Chipped-glass** (Not Ill.)	4226	----	..	.....	..	1 ft. 2 in. x 6 in.	Set in putty all round and secured with	
242	64	**Glass-beads** (Not Ill.)	4073	C.	..	.....	..	5-16 in. x ¾ in.	Same as shown on Plate XI. (9125) Figs. 593 and 594, screwed to the sash with 160 No. 5 x ⅝ in. bronze screws	Molding machine
243	..	**10 Ventilator side-sashes** (Fig. 410)	4001	C.	..	.....	..	.....	In the center of the body, stationary but removable, without mullions, composed of:—	
243a	10	**Top-rails** (Fig. 415)	4003	C.	..	.....	..	2 ft. 4¼ in. x 1¼ in. x ¾ in.	All joints mortised, tenoned and glued, each having one edge rabbeted 7-16 in. x ¼ in. to receive the glass, fixed in position with	Variety machine, end tenoner and hollow-chisel mortiser
243b	10	**Bottom-rails** (Fig. 416)	4004	C.	..	.....	..	2 ft. 4¼ in. x 1½ in. x ¾ in.		
243c	20	**Stiles** (Fig. 412)	4006	C.	..	.....	..	8¼ in. x 1¼ in. x ¾ in.		
244	20	**Ventilator-sash buttons** (Fig. 524)	4521	Bz.	..	.....	..	.....	Screwed to the sash stiles with 20 No. 6 x ⅝ in. bronze screws, and	
245	20	**Ventilator-sash stops** (Fig. 509)	4522	Bz.	..	.....	..	.....	Screwed to the outside of the ventilator side-posts with 80 No. 6 x ⅝ in. bronze screws	
246	10	**Ground-glass** (Not Ill.)	4227	----	..	.....	..	2 ft. 4¾ in. x 6 in.	Set in putty all round and screwed with	
246a	40	**Glass-beads** (Not Ill.)	4073	C.	..	.....	..	5-16 in. x ¾ in.	Same as Con. No. 242, screwed to the sashes with 160 No. 5 x ⅝ in. bronze screws	Molding machine
247	..	**2 Ventilator end-sashes** (Fig. 417)	4007	C.	..	.....	..	8 in. x 3 ft. 7¼ in.	Composed of:—	
247a	2	**Top-rails** (Fig. 418)	4008	C.	..	.....	..	3 ft. 4¾ in. x 1¼ in. x ¾ in.	All joints mortised, tenoned and glued, each having one edge rabbeted 7-16 in. x ¼ in. to receive the glass, the sashes being set in putty and secured in the rabbets in the end top-rail (1006) and the upper-deck head-rafter (2006) with 20 No. 9 x 1¼ in. bronze screws	Variety machine, end tenoner and hollow chisel mortiser
248	2	**Bottom-rails** (Fig. 419)	4009	C.	..	.....	..	3 ft. 4¾ in. x 1¼ in. x ¾ in.		
249	4	**Stiles** (Fig. 413)	4011	C.	..	.....	..	8¼ in. x 1¼ in. x ¾ in.		
250	2	**Mullions** (Fig. 414)	4010	C.	..	.....	..	5¼ in. x 1 in. x ¾ in.		
250a	4	**Ground-glass** (Not. Ill.)	4227	----	..	.....	..	3 ft. 5¼ in. x 6¼ in.	Set in putty all round and secured with	
250b	16	**Glass-beads** (Not Ill.)	4073	C.	..	.....	..	5-16 in. x ¾ in.	Same as Con. No. 242, screwed to the sashes with 64 No. 5 x ⅝ in. bronze screws	Molding machine
251	..	**18 Side-sashes** (Fig. 423)	4012	C.	..	.....	..	2 ft. 10⅛ in. x 2 ft. 7 in.	Composed of:—	
251a	18	**Top-rails** (Fig. 421)	4013	C.	..	.....	..	2 ft. 2½ in. x 2⅝ in. x ¾ in.	All joints mortised, tenoned and glued, each having one edge rabbeted 7-16 x ¼ in. to receive the glass	Variety machine, end tenoner and hollow-chisel mortiser
252	18	**Bottom-rails** (Fig. 422)	4014	C.	..	.....	..	2 ft. 2½ in. x 3½ in. x ¾ in.		
253	36	**Stiles** (Fig. 420)	4015	C.	..	.....	..	2 ft. 10⅛ in. x 2¼ in. x ¾ in.		
254	18	**American plate-glass** (Not Ill.)	4225	----	..	.....	..	2 ft. 4¾ in. x 2 ft. 3 in.	Set in putty all round and secured with	
254a	72	**Glass-beads** (Not Ill.)	4073	C.	..	.....	..	5-16 in. x ¼ in.	Same as Con. No. 242, screwed to the sashes with 576 No. 5 x ⅝ in. bronze screws	Molding machine
255	36	**Sash anti-rattle springs** (Fig. 492)	4536	S. S.	..	.....	..	.....	Known as Scott springs, screwed to the stiles with 72 No. 8 x ⅝ in. nickel screws	
256	18	**Sash top-lifts** (Fig. 522)	4528	Bz.	..	.....	..	.....	Screwed to the sash top-rails with 54 No. 9 x ⅝ in. bronze screws	
257	18	**Sash leather-lifts** (Fig. 513)	4530	----	..	.....	..	.....	Secured to the sash bottom-rails with	
258	18	**Sash leather-lift plates** (Fig. 523)	4529	Bz.	..	.....	..	.....	Screwed with 54 No. 9 x ⅝ in. bronze screws	
258a	..	**Post-parting strips**	1035	C.	..	.....	..	.....	Described Con. Nos. 34, 37b and 45, Table No. 33 are now finally screwed in place. (See (f) Figs. 80, 81 and (r) Figs. 78, Plate V.)	
259	..	**4 End-sashes** (Fig. 426)	4016	C.	..	.....	..	2 ft. 10⅛ in. x 2 ft. 0½ in.	Composed of:—	
259a	4	**Top-rails** (Fig. 425)	4017	C.	..	.....	..	1 ft. 7½ in. x 2⅝ in. x ¾ in.	All joints mortised, tenoned and glued, each having one edge rabbetted 7-16 in. x ¼ in. to receive the glass	Variety machine, end tenoner and hollow-chisel mortiser
260	4	**Bottom-rails** (Fig. 427)	4018	C.	..	.....	..	1 ft. 7½ in. x 3½ in. x ¾ in.		
261	8	**Stiles** (Fig. 424)	4019	C.	..	.....	..	2 ft. 10⅛ in. x 2½ in. x ¾ in.		
261a	4	**American plate-glass** (Not Ill.)	4225	----	..	.....	..	2 ft. 4¾ in. x 1 ft. 8 in.	Set in putty all round and secured with	
261b	16	**Glass-beads** (Not Ill.)	4073	C.	..	.....	..	5-16 in. x ¼ in.	Same as Con. No. 242, screwed to the sashes with 112 No. 5 x ⅝ in. bronze screws	Molding machine
262	..	**2 Doors** (Fig. 457)	4055	C.	..	.....	..	6 ft. 4¼ in. x 2 ft. 3½ in.	Composed of:—	
262a	2	**Top-rails** (Fig. 456)	4056	C.	..	.....	..	1 ft. 6 in. x 6 in. x 1⅛ in.	All joints mortised, tenoned and glued, panels adjusted and glued, edges of the rails rabetted 9-16 in. x 5-16 in. to receive the glass, and grooved 1 in. x 7-16 in. to receive the panels	Variety machine, end tenoner, hollow-chisel mortiser and panel raiser
263	2	**Bottom-rails** (Fig. 458)	4057	C.	..	.....	..	1 ft. 6 in. x 7⅜ in. x 1⅛ in.		
264	2	**Middle-rails** (Fig. 459)	4058	C.	..	.....	..	1 ft. 6 in. x 7 in. x 1⅛ in.		
265	2	**Change-slide caps** (Fig. 461)	4059	C.	..	.....	..	1 ft. 6 in. x 4¾ in. x 1⅛ in.		
266	2	**Parting-rails** (Fig. 460)	4060	C.	..	.....	..	1 ft. 11 in. x 3 ft. x 1⅛ in.		
267	2	**Mullions** (Fig. 463)	4061	C.	..	.....	..	9 in. x 3 in. x 1⅛ in.		
268	8	**Panels** (Fig. 464)	4062	C.	..	.....	..	10 in. x 7½ in. x ⅝ in.		
269	4	**Stiles** (Figs. 455, 467)	4063	C.	..	.....	..	6 ft. 4¼ in. x 4¾ in. x 1⅛ in.		
269a	2	**American plate-glass** (Not Ill.)	4225	----	..	.....	..	2 ft. 11½ in. x 1 ft. 6 in.	Set in putty all round and secured with	
269b	8	**Glass-beads** (Not Ill.)	4073	C.	..	.....	..	7-16 in. x 5-16 in.	Screwed to the door frame with 46 No. 5 x ⅝ in. bronze screws	Molding machine
270	2	**Door change-slides** (Fig. 462)	4506	Bz.	..	.....	..	6 1-16 in. x 4 1-16 in. x 9-32 in.	Adjusted in the wide channel in the door middle-rail, covered with the change-slide cap and prevented from rattling by	
271	2	**Door change-slide springs** (Fig. 517)	4507	S. S.	..	.....	..	.....	Screwed to the middle rail with 2 No. 2 x ½ in. bronze screws	
272	2	**Door-bottom wear-plates** (Fig. 480)	4501	W. I.	..	.....	..	.....	Screwed to the bottom of the doors with 10 No. 12 x 1¼ in steel screws	
273	8	**Door wear-strips** (Fig. 481)	4502	Bz.	..	.....	..	.....	Screwed to the door bottom and middle-rails with 16 No. 6 and 14 No. 7 x ½ in. bronze screws. The doors are now ready for hanging from the tracks as follows:	
274	2	**Sliding-door top-tracks** (Fig. 482)	4508	W. I.	..	.....	..	.....	Screwed to the end top-rail through furring pieces (1038), Fig. 138, Plate V. (*See Con. No. 60, Table No. 33*) with 10 No. 12 x 1½ in. steel screws	
275	2	**Sliding-door rear-tracks** (Fig. 483)	4509	W. I.	..	.....	..	.....	Screwed to the end top-rail through furring pieces (1038), Fig. 139, Plate V. (See Con. No. 70, Table No. 33) with 10 No. 12 x 1¾ in. steel screws	
276	2	**Sliding-door top-sheaves** (Fig. 496)	4510	M. I.	..	.....	..	.....	With	
277	2	**do. do. holders** (Fig. 496)	4511	Bz.	..	.....	..	.....	And	
278	2	**do. do. plates** (Fig 501)	4512	Bz.	..	.....	..	.....	Screwed to the top of the doors with 8 No. 16 x ¾ in. machine screws	

For General View of Inside of Boston Closed Car, see Plate XII.

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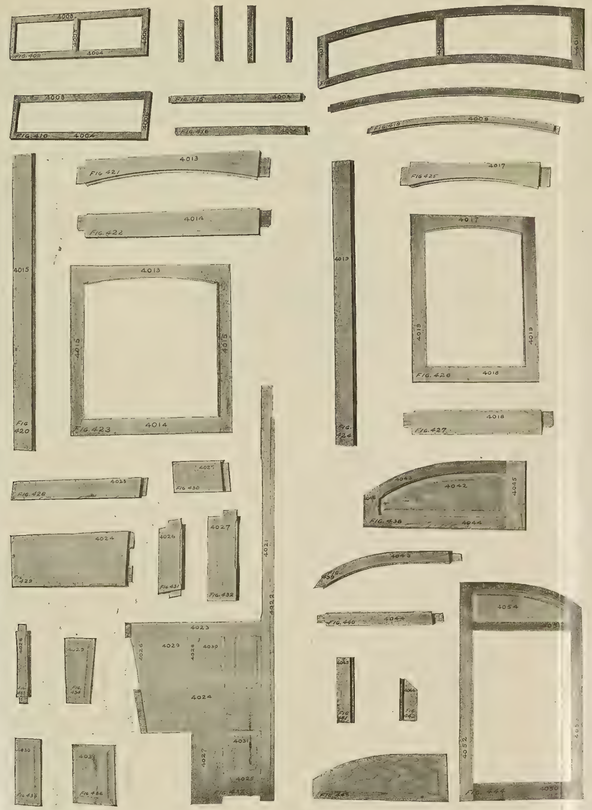
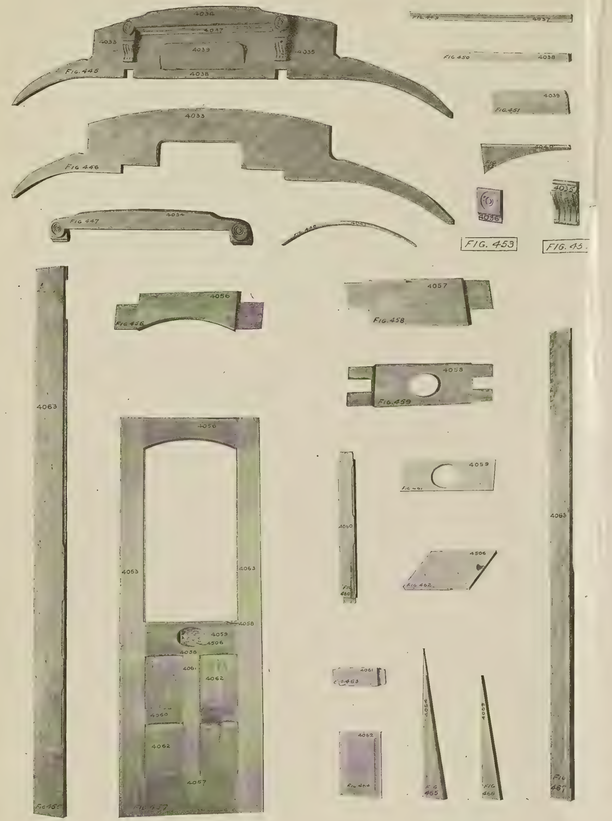
CAR

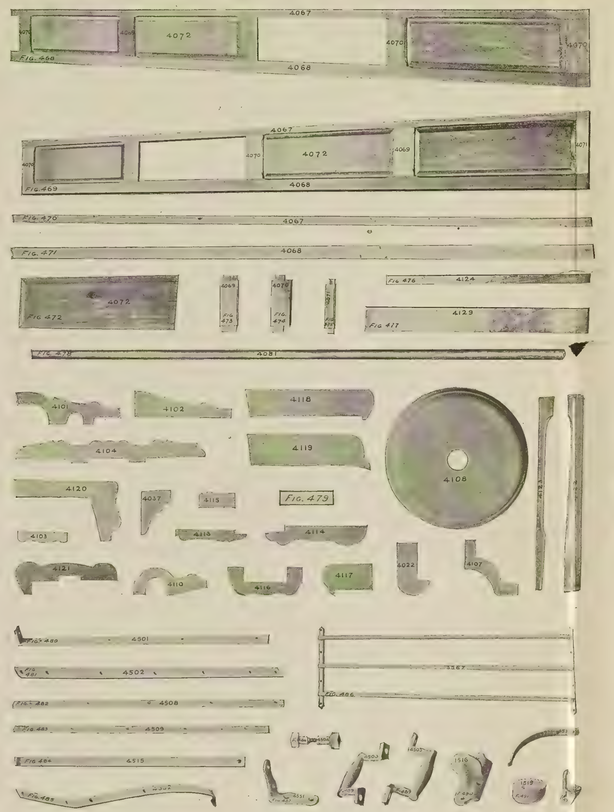
BOSTON CLOSED CAR. (Table No. 39.)



BOSTON CLOSED CAR. (Table No. 39.)



BOSTON CLOSED CAR. (Table No. 39.)



BOSTON CLOSED CAR. (Table No. 39.)

PLATE XI. [Figs. 409 to 524.]

DETAILS OF CABINET WORK, TRIMMINGS, ETC., OF

BOSTON CLOSED STANDARD CAR

ILLUSTRATING

STREET CAR BUILDING

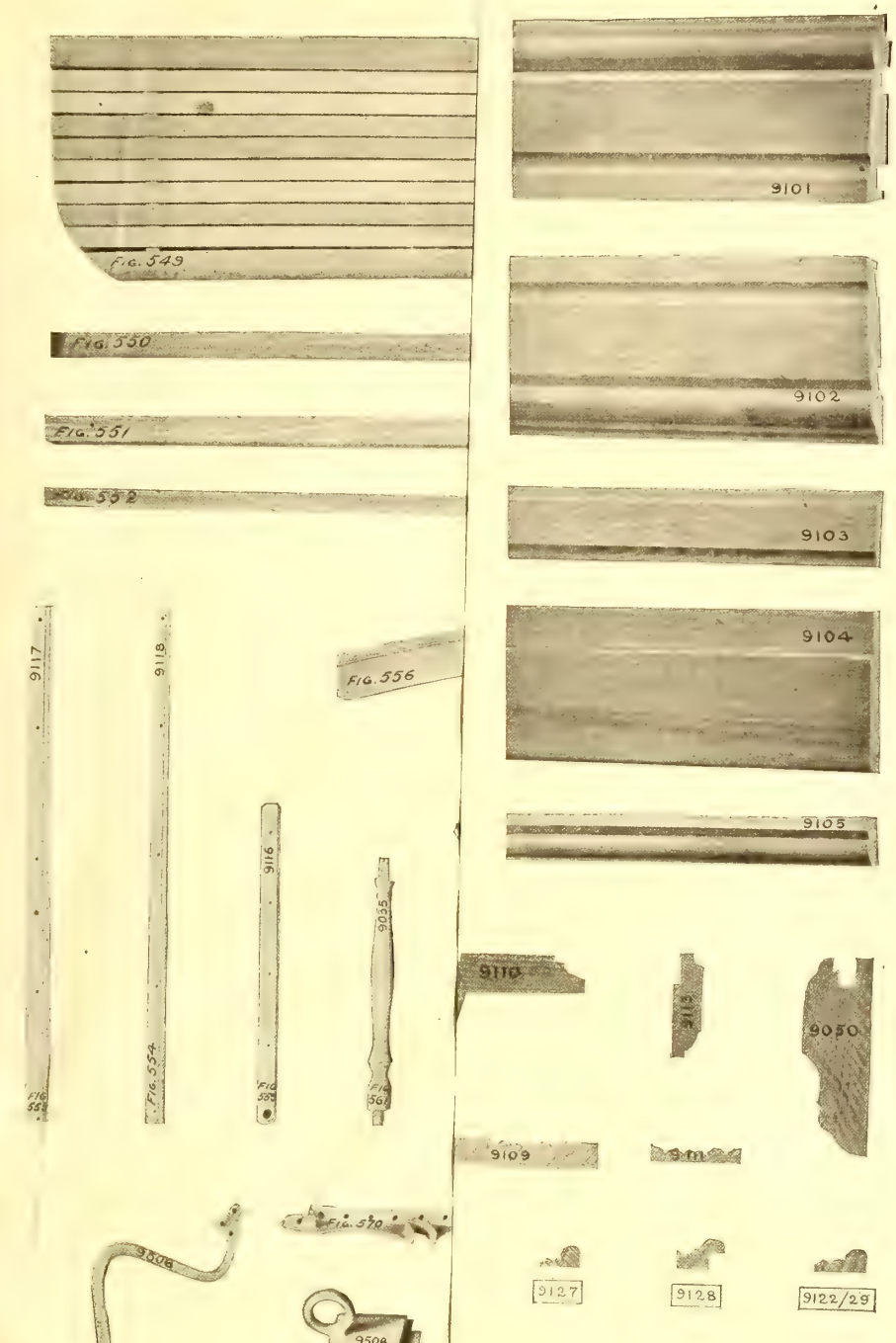
(Stephenson Practice)

By

Charles Henry Davis, C. E.

For General View of Inside of Boston Closed Car, see Plate XII.

BROC 40.)



594.]

GS, ETC., OF

OARD CAR

BOSTON CLOSED CAR. (Table No. 39.)

To Complete Plate XI.

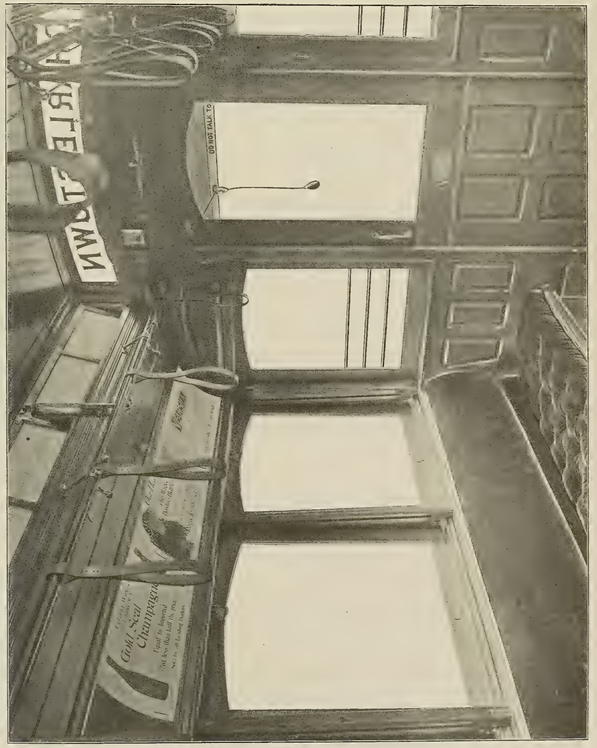
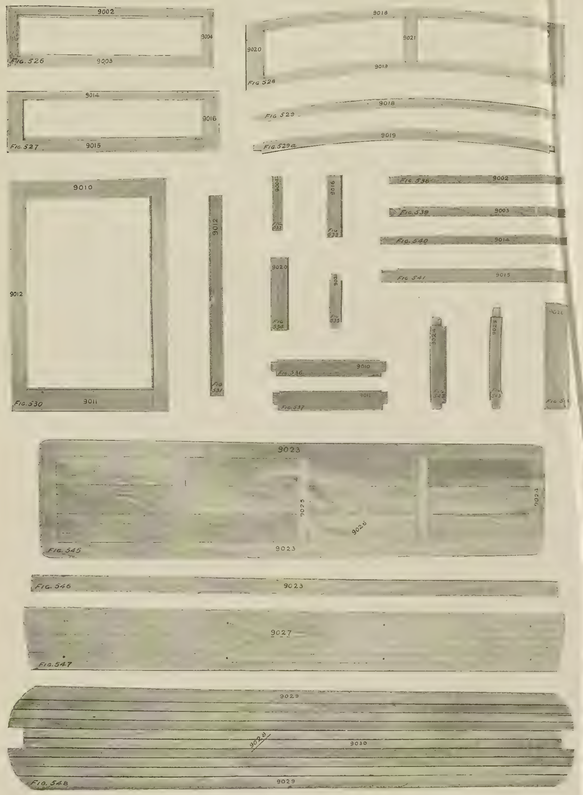
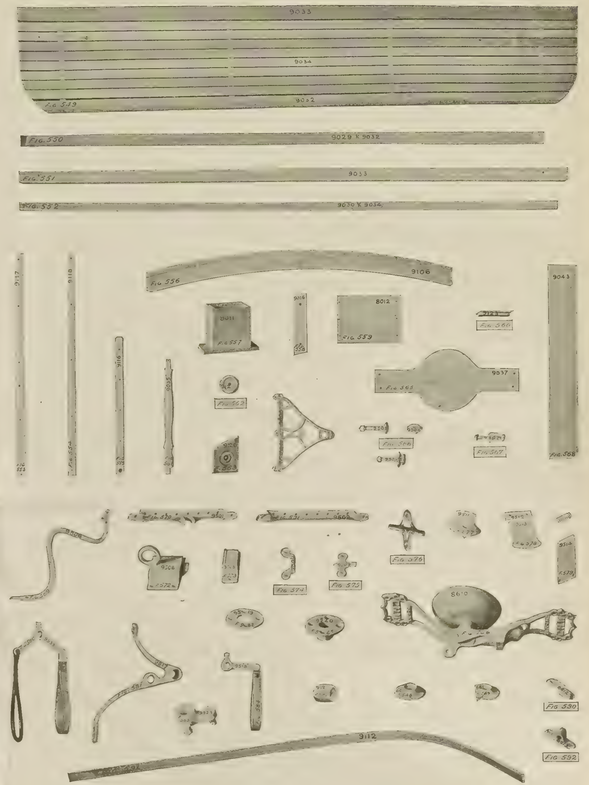


FIG. 525

BROOKLYN OPEN CAR. (Table No. 40.)



BROOKLYN OPEN CAR. (Table No. 40.)



BROOKLYN OPEN CAR. (Table No. 40.)

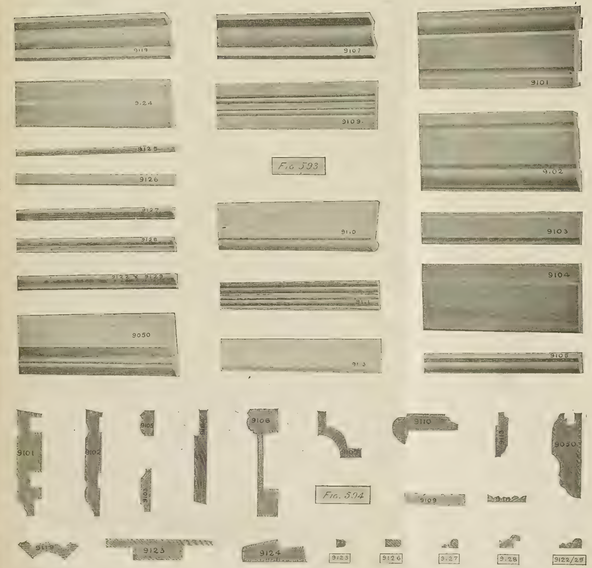


PLATE XII. [Figs. 525 to 594.]

DETAILS OF CABINET WORK, TRIMMINGS, ETC., OF

BROOKLYN OPEN STANDARD CAR

ILLUSTRATING

STREET CAR BUILDING

(Stephenson Practice)

By

Charles Henry Davis, C. E.

(25 ft. Body; Car No. 2; Fig. 3; Plates I., XI. and XII.)

279	2	**Sliding-door rear-sheaves** (Fig. 495)	4513	M. I	--		--		And	
280	2	**do. do. holders** (Fig. 495)	4514	Bz.	--		--		Screwed to the rear door-stile with 8 No. 10 x 1 in. steel screws	
281	2	**Sliding-door rear-sheave guides** (Fig. 484)	4515	W. I	--		--		Screwed to the corner and door-posts with 4 No. 12 x 1¼ in. steel screws (see 1004 j, Fig. 85, Plate V., and Con. No. 47, Table No. 33)	
282	4	**Rubber door-steps** (Fig. 499)	4083	----	--		--		Screwed to the door stop-blocks (1049), Fig. 140, Plate V., with 8 No. 6 x ¾ in. steel screws. (See Con. No. 100, Table No. 33)	
283	4	**Door-handles** (Fig. 489)	4503	Bz.	--		--		Secured one to each side of door with	
284	2	**Door-handle stub-bolts** (Fig. 488)	4504	Bz.	--		--		Securing the handles on each side of the door at same time	
285	--	**4 End-linings** (Fig. 437)	4020	C.	--		--		Composed of:—	
285a	4	**Stiles** (Fig. 437)	4021	C.	--	6 ft. 6⅛ in. x 2 in. x ⅞ in.	--		All joints mortised, tenoned and glued, panels adjusted and glued, edges of rails grooved ¼ in. x ¾ in. to receive the panels; the linings are secured as follows: Left-hand stiles screwed to end top-rail furring (1038), Fig. 111, Plate V., with 4 No. 10 x 1¼ in. steel screws, and to the left door-posts (thick, 1003), Fig. 75, Plate V., with 18 No. 10 x 1½ in. bronze screws; right-hand stiles screwed to end top-rail furring with 4 No. 10 x 1¾ in. steel screws; right and left-hand stiles fitted to mortises (o) in the end-sills (2), Fig. 36, Plate IV.; top-rails tenoned into mortises (k) of the corner-posts (1001), Fig. 79, Plate V., and screwed to door stop-blocks (1049), Fig. 140, Plate V., with 4 No. 10 x 1½ in. bronze screws; middle-rails tenoned into mortises (l) of the corner-posts (1001), Fig. 79, Plate V.	Variety machine, end tenoner, hollow-chisel mortiser and panel raiser
286	4	**Top-rails** (Fig. 428)	4023	C.	--	2 ft. 05⅛ in. x 2¾ in. x ⅞ in.	--			
287	4	**Middle-rails** (Fig. 429)	4024	C.	--	1 ft. 10⅝ in. x 8⅜ in. x ⅞ in.	--			
288	4	**Bottom-rails** (Fig. 430)	4025	C.	--	7¼ in. x 3½ in. x ⅞ in.	--			
289	4	**Back-rails** (Fig. 431)	4026	C.	--	10 in. x 4⅝ in. x ⅞ in.	--			
290	4	**Upright-rails** (Fig. 432)	4027	C.	--	11⅛ in. x 4⅝ in. x ⅞ in.	--			
291	8	**Parting-rails** (Fig. 433)	4028	C.	--	10 in. x 2 in. x ¾ in.	--			
292	4	**Back upper-panels** (Fig. 434)	4029	C.	--	10½ in. x 6¼" x 4⅝ in. x ½"	--			
293	8	**Upper-panels** (Fig. 435)	4030	C.	--	10½ in. x 5⅛ in. x ½ in.	--			
294	4	**Lower-panels** (Fig. 436)	4031	C.	--	9 in. x 7¾ in. x ½ in.	--			
295	--	**2 End-lining head-panels** (Fig. 438)	4042	C.	--		--		Composed of:—	
295a	2	**Top-rails** (Fig. 439)	4043	C.	--	1 ft. 7½ in. x 1¾ in. x ⅞ in.	--		All joints mortised, tenoned and glued, panels adjusted and glued, edges of the rails grooved ¼ in. x ¾ in. to receive the panels; they are secured to the end top-rail on the left side of the door with 8 No. 10 x 1½ in. bronze screws	Variety machine, end tenoner, hollow-chisel mortiser and panel raiser
296	2	**Bottom-rails** (Fig. 440)	4044	C.	--	1 ft. 7½ in. x 2 in. x ⅞ in.	--			
297	2	**Front-stiles** (Fig. 441)	4045	C.	--	10 in. x 2½ in. x ⅞ in.	--			
298	2	**Back-stiles** (Fig. 442)	4046	C.	--	6¼ in. x 2½ in. x ⅞ in.	--			
299	2	**Raised-panels** (Fig. 443)	4047	C.	--	1 ft. 8 in. x 6¾ in. x ½ in.	--			
300	--	**2 End-lining hinged-sashes** (Fig. 444)	4048	C.	--		--		Composed of :-	
300a	2	**Top-rails** (Fig. 444)	4049	C.	--	1 ft. 7½ in. x 1¾ in. x ⅞ in.	--		All joints mortised, tenoned and glued, edges of the rails grooved ¼ in. x ¾ in. to receive the panels and rabbeted 7-16 in. x ¼ in. to receive the glass	Variety machine, end tenoner, hollow-chisel mortiser and panel raiser
301	2	**Bottom-rails** (Fig. 444)	4050	C.	--	1 ft. 7½ in. x 8½ in. x ⅞ in.	--			
302	2	**Middle-rails** (Fig. 444)	4051	C.	--	1 ft. 7½ in x 2 in. x ⅞ in.	--			
303	2	**Front-stiles** (Fig. 444)	4052	C.	--	3 ft. 7⅛ in. x 2½ in. x ⅞ in.	--			
304	2	**Back-stiles** (Fig. 444)	4053	C.	--	3 ft. 3¾ in. x 2½ in. x ⅞ in.	--			
305	2	**Raised-panels** (Fig. 444)	4054	C.	--	1 ft. 8 in. x 6¼ in. x ½ in.	--			
305a	2	**American plate-glass** (Not Ill.)	4225	----	----	2 ft. 6⅛ in. x 1 ft. 8 in.	----		Set in putty all round and secured with	
305b	8	**Glass-beads** (Not Ill.)	4073	C.	--	7-16 in. x 5-16 in.	--		Secured to the sash frame with 42 No. 5 x 5/8 in. bronze screws	Molding machine
306	6	**Hinged-sash hinges** (Fig. 519)	4526	Bz.	--		--		Screwed to the hinged sashes and the end-lining stiles with 36 No. 7 x ⅞ in. bronze screws	
307	4	**Hinged-sash latches and keepers** (Figs. 515, 516)	4523	Bz.	--		--		Adjusted to the sashes and screwed to the end-lining stiles with 8 No. 7 x ⅞ in. bronze screws	
308	--	**2 Door-head linings complete** (Fig. 445)	4032	C.	--		--		Composed of:—	
308a	2	**Linings** (Fig. 446)	4033	C.	--		--		Screwed to end top-rail furring (1038), Fig. 111, Plate V., with 12 No. 10 x 2½ in. bronze screws	Variety machine
309	2	**Lining-cornices** (Fig. 447)	4034	C.	--		--		Screwed to the lining with 4 No. 10 x 2½ in. bronze screws	Variety machine and router
310	4	**Lining-pilasters** (Fig. 454)	4035	C.	--		--		Glued to the lining	Router
311	4	**Rosettes** (Fig. 453)	4036	C.	--		--		Screwed to the lining with 4 No. 7 x ⅞ in. bronze screws	Molding machine and router
312	2	**Cornice-moldings** (Fig. 449)	4037	C.	--		--		Nailed to the lining	Molding machine
313	2	**Door-sheave transom-sills** (Fig. 450)	4038	C.	--		--		Screwed to the lining	Molding machine & variety machine
314	2	**Door-sheave transoms** (Fig. 451)	4039	C.	--	1 ft. 4 in. x 4 in.	--		Hinged with	Variety machine
315	4	**Door-sheave transom-hinges** (Fig. 520)	4527	Bz.	--		--		Screwed to the transoms and transom-sills with 24 No. 4 x ½ in. bronze screws	Variety machine
316	2	**Door-sheave transom-latches** (Fig. 516)	4525	----	----		----		Same as (4523) Con. No. 307	
317	4	**Door-case corners** (Fig. 452)	4040	C.	--		--		Tongued and grooved to fit the bottom of the door-sheave transom-sills, and held in place with	Variety machine
318	2	**Door-case moldings** (Fig. 448)	4041	C.	--		--		The same as	Molding machine
319	2	**End-lining stile-moldings** (Fig. 479)	4022	C.	--		--		Shown in section, adjusted all round the door-case and secured with 44 No. 10 x 1¼ in to 1¾ in. bronze screws	Molding machine
320	4	**Hinged-sash stops** (Fig. 476)	4124	C.	--		--		Are now screwed to the corner and right door-posts with 34 No. 7 x ⅞ in. bronze screws	Variety machine
321	2	**Inside crows-feet** (Fig. 465)	4064	C.	--		--		Tenoned into mortise (o) in the end-sills Fig. 36, Plate IV., nailed to the right end-lining stiles, and finished off with the end-lining stile-molding carried down to the floor	Variety machine
322	2	**Outside crows-feet** (Fig. 466)	4065	C.	--		--		Screwed to the right door-post (1004) with No. 10 x 1¾ in. to 2½ in. bronze screws	Variety machine
322a	4	**Rubber door-stops** (Fig. 499)	4083	----	--		--		Screwed to the left door-posts (1003) with 8 No. 6 x ¾ in. bronze screws	
323	2	**Corner-post end-facia** (Fig. 479)	4122	C.	--	⅜ in. thick	--		And	Variety machine
324	2	**Corner-post side-facia** (Fig. 479)	4123	C.	--	⅜ in. thick	--		Screwed to the left hand corner-posts with 24 No. 7 x ⅞ in. bronze screws	Variety machine
325	2	**Electric dry-battery shelves** (Not Ill.)	----	P.	--		--		Screwed to the end top-rail furring at one end of the car behind the end-lining head-panel, with 4 No. 10 x 1¼ in. steel screws, and placed on it are	
326	2	**Electric dry-batteries** (Fig. 507)	4086	----	--		--		For supplying current to the electric-bells from the electric-bell push-buttons on the side-posts	
327	9	**Upper-deck panel-ceilings** (Not Ill.)	4074	O.	--		--		3-ply oak, screwed to the upper-deck furring (2021) with about 90 No. 6 x ¾ in. steel screws, and nailed to the upper-deck rafters	
328	2	**Lower-deck panel-ceilings** (Not Ill.)	4075	O.	--		--		3-ply oak, screwed to the ventilator bottom-rail and the plain advertising rack-rail with about 80 No. 6 x ¾ in. steel screws	
329	2	**Side crown-moldings** (Fig. 479)	4101	C.	--		--		And	Molding machine
330	4	**End crown-moldings** (Fig. 479)	4102	C.	--		--		Screwed on the sides and ends of the upper-deck panel-ceilings to the upper-deck furring with 64 No. 10 x 1¼ in. bronze screws, to secure the panels, add to the appearance and cover the electric wires	Molding machine
331	8	**Head-lining joint-moldings** (Fig. 479)	4103	C.	--		--		Bradded over joints of upper-deck panel-ceilings	Molding machine
332	4	**Ventilator corner-moldings** (Fig. 479)	4107	C.	--		--		Screwed to ventilator-posts with 16 No. 7 x ⅞ in. bronze screws	Molding machine
333	7	**Ceiling-rosettes** (Fig. 479)	4108	C.	--		--		For electric lamps, screwed to upper-deck rafters with 14 No. 7 x 1¼ in. steel screws	Lathe
334	2	**Ventilator bottom-rail facia** (Fig. 479)	4104	C.	--		--		Glued and nailed to the ventilator bottom-rail	Molding machine
335	4	**End top-rail facia** (Fig. 479)	4106	C.	--		--		Same molding as the ventilator bottom-rail facia (4104), screwed on each side of the door-head lining with 16 No. 7 x ¾ in. bronze screws	
336	2	**Side-ceiling moldings** (Fig. 479)	4110	C.	--		--		Screwed to under side of the ventilator bottom-rails with 54 No. 10 x 1¼ in. bronze screws	Molding machine
337	2	**Upper advertising-moldings** (Fig. 479)	4113	C.	--		--		Nailed to the lower-deck furring (2024)	Molding machine
338	2	**Lower advertising-moldings** (Fig. 479)	4114	C.	--		--		Screwed to the face of the plain advertising-rack rail (1069) with 54 No. 10 x 1¼ in. bronze screws	Molding machine
339	2	**Advertising rack-rail moldings** (Fig. 479)	4115	C.	--		--		Nailed to the under side of the advertising-rack rail	Molding machine
340	16	**Side-post caps** (Fig. 479)	4116	C.	--		--		Screwed to the side-posts with 64 No. 10 x 1¼ in. bronze screws, each one having a round hole in it for	Molding machine
341	16	**Electric-bell push-buttons** (Fig. 521)	4538	----	--		--		Adjusted to the side-post caps and connected by wires running from the electric dry-batteries to the electric-bells	
342	2	**Hinged-sash sills** (Fig. 479)	4117	C.	--		--		Screwed to the end-lining top-rails (4023) with 6 No. 10 x 1¼ in. bronze screws	Molding machine
343	2	**End-sash sills** (Fig. 479)	4118	C.	--		--		Screwed to the end-lining top-rails (4023) with 6 No. 10 x 1¼ in. bronze screws	Molding machine
344	--	**2 Seat-fronts** (Figs. 468, 469)	4066	C.	--		--		In two pieces, composed of:—	
344a	4	**Top-rails** (Fig. 470)	4067	C.	--	24 ft. 3⅞ in. x 1⅜ in. x ¾ in.	--		All joints mortised, tenoned and glued, edges of the rails rabbeted ¼ in. x ¾ in. to receive the panels, screwed to the seat-legs (1058) Fig. 134, Plate V., with 32 No. 12 x 1½ in. steel screws	Variety machine, end tenoner, hollow-chisel mortiser and panel raiser
345	4	**Bottom-rails** (Fig. 471)	4068	C.	--	24 ft. 3⅞ in. x 2¼ in. x ¾ in.	--			
346	4	**Mullions** (Fig. 473)	4069	C.	--	8½ in. x 4 in. x ¾ in.	--			
347	14	**Wide end-rails** (Fig. 474)	4070	C.	--	8½ in. x 4 in. x ¾ in.	--			
348	4	**Narrow end-rails** (Fig. 475)	4071	C.	--	8½ in. x 2 in. x ¾ in.	--			
349	12	**Raised-panels** (Fig. 472)	4072	C.	--	2 ft. 4½ in. x 9 in. x ½ in.	--			

TABLE NO. 39—*Continued*

Consecutive Number	Quantity	Name of Piece	Piece Number Plates I. and XI.	Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate XI.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
349a	48	**Panel-beads** (Not Ill.)	4073	C.	..		..	5-16 in. x ¼ in.	Screwed to the different rails	
350	2	**Front seat-supporting-rail facia** (Fig. 479)	4121	C.	..		..		Glued and nailed to the front seat-supporting-rail (1057)	Molding machine
351	2	**Front seat-rail knees** (Fig. 487)	4531	Bz.	..		..		Screwed to the front seat-supporting-rail and the end-lining middle-rail with 4 No. 10x 1½ in. and 4 No. 10 x ¾ in. bronze screws	
352	2	**2 Plush seat-backs** (Not Ill.)	4076	....	..		..		Composed of:—	
352a	2	**Seat-back boards** (Not Ill.)	4077	A.	..		..		And	
353	6	**Seat-back battens** (Not Ill.)	4078	A.	..		..		Screwed to them with 46 No. 10 x 1 in. steel screws; to the seat-back boards are also screwed at the ends	
354	4	**Seat-back cleats** (Not Ill.)	4079	A.	..		..		With 12 No. 12 x 1½ in. steel screws to give the form of the seat-back which is of curled hair covered with crimson mohair plush; the seat-backs are then screwed to the side-posts with 32 No. 12 x 1¼ in. steel screws and to the seat-rail cleats (1056) Fig. 132, Plate V., with 8 No. 12 x 1¼ in. and 2 in. steel screws	
355	4	**Seat-back end-straps** (Fig. 485)	4532	Bz.	..		..		Screwed to the seat-back cleats with 24 No. 7 x ⅞ bronze screws	Molding machine
356	2	**Seat-back caps** (Fig. 479)	4119	C.	..		..		Screwed to the top of the seat-back boards with 54 No. 10 x 1¾ in. bronze screws	
357	6	**Squab seat-cushions** (Not Ill.)	4080	....	..		..		Each filled with 18 lbs. of curled hair and covered with crimson mohair plush top, same as the seat-back, and duck bottom, are laid on the seat-lid boards (1062) Con. No. 97a, Table 33.	
358	18	**Sash winter-casings** (Fig. 479)	4120	....	..		..		Are secured against the side-sashes by	Molding machine
359	36	**Winter-casing knees** (Fig. 493)	4537	Bz.	..		..		Screwed to the side and corner-posts with 36 No. 12 x 1 in. bronze screws	
360	2	**Inside window-stops** (Fig. 477)	4129	C.	..		..		Screwed to the door-posts (1003) with 16 No. 7 x ⅞ in. bronze screws to secure the left-hand end-sashes (4016)	
361	18	**Spring-roller shades** (Fig. 494)	4084	....	..		..		With Burrowes' patent automatic shade-holding device, hung in sockets screwed to the side and corner-posts with 72 No. 4 x ½ in. steel screws	
362	2	**Hand-poles** (Fig. 478)	4081	C.	..		..	1¼ in. diam.	Upon which are placed	Lathe
363	36	**Hand-pole straps** (Fig. 508)	4082	....	..		..		Of leather, the poles being secured with 4 No. 8 x ¾ in. bronze screws to	
364	2	**Hand-pole sockets** (Fig. 510)	4517	Bz.	..		..		Screwed to the door-head lining on the right side with 8 No. 8 x ¾ in. bronze screws, and	
365	2	**Hand-pole sockets with eyelets** (Fig. 511)	4518	Bz.	..		..		Screwed to the door-head lining on the left side with 6 No. 8 x ¾ in. bronze screws	
366	18	**Hand-pole brackets** (Fig. 506)	4516	Bz.	..		..		Are also screwed to the lower-deck rafters and the ventilator bottom-rail facia with 72 No. 8 x 1 in. bronze screws	
367	6	**Bell-cord bushes** (Fig. 503)	3570	Bz.	..		..		Secured to the end top valance and door-head linings with 6 No. 5 x ⅝ in. bronze screws	
368	2	**Bell-cord sheaves** (Fig. 502)	2509	Bz.	..		..		Screwed to the platform-hood bow with 8 No. 8 x ¾ in. and 1 in. bronze screws	
369	2	**Signal-bells** (Fig. 504)	3568	Bz.	..		..		Screwed to the platform-hood with 8 No. 12 x 1¼ in. bronze screws	
370	2	**Bell-cord couplings** (Fig. 500)	3569	Bz.	..		..		For coupling and uncoupling the bell-cord	
371	2	**Electric-bells** (Fig. 498)	3571	....	..		..		"King" pattern operated by the electric-bell push-buttons on the side-posts, screwed to the end top-valance with 4 No. 7 x ⅞ in. steel screws	
372	1	**Electric-bell switch** (Fig. 514)	3572	....	..		..		Screwed to the door-head lining with 1 No. 7 x ⅞ in. bronze screw, to open and close the circuit from the batteries to the bells	
373	4	**Platform window-guards** (Fig. 486)	3567	Bz.	..		..		Screwed to the corner and door-post moldings with 32 No. 12 x 1½ in. bronze screws	
374	2	**Fender-rail trolley-steps** (Fig. 491)	1515	Bz.	..		..		Screwed to the fender-rails with 8 No. 10 x 1½ in. steel screws	
375	2	**Corner-post trolley-steps** (Fig. 493)	1516	Bz.	..		..		Screwed to the corner-posts with 8 No. 10 x 1½ in. steel screws	
376	2	**Door anti-rattle springs** (Fig 505)	4505	S.S.	..		..		Screwed to end-lining with 4 No. 7 x ⅞ in. bronze screws	
377	1	**Sign-stick socket** (Fig. 512)	4539	M.I.	..		..		Screwed to the end-lining bottom-rail with 4 No. 10 x 1 in. steel screws.	
									While the assembling of the different parts and pieces of the Cabinet Work, Trimmings, etc., has been carried on, the painting of the cars is proceeded with from the point reached in Table No. 35, Con. No. 128, as follows:—10th day, Give a coat of lead tinted with the required color; 11th day, Second coat of color; 12th day, Third coat of color with enough varnish to make a gloss; 13th day, Rub with felt, powdered pumice stone and water, then wash with sponge and dry with chamois skin; 14th day, Stripe, letter and ornament; 15th day, Give a coat of Ry. Coach finishing varnish; 16th day, Second coat of varnish. This method is followed for other painted and ornamented parts besides the body, as platform-sills, step-hangers, fenders and dashers. All the iron-work is painted:—dasher-rail and posts, 2 coats of black; platform-hood supports, 3 coats black; buffer, 2 coats black then white numbers (of the car) and varnished. Iron-work under car, one coat Princes Metallic. Under side of platform-hood painted white. There are four transfers on the upper end-panels and two on the end sashes. The interior finish is natural cherry, no stain used, shellacked, 2 coats inside varnish rubbed to a flat finish. Ceiling-panels, flat finish and decorated, with one coat of lead and oil on the back. Sash and doors finished on the outside in natural wood with 2 coats inside varnish and 1 coat of body varnish. The ventilator sashes lettered in black on the ground side of the glass.	

Number of Distinctive Pieces	144	(Column 1)
Total Number of Pieces	1338	(" 2)
Number of Bolts	None	(" 6 and 10)
Number of Screws (about)	3700	(" 6 and 10)
Number of Nails	?	
Total	5038 +	

TABLE NO. 40

DETAIL OF CABINET WORK, TRIMMINGS, ETC., OF BROOKLYN OPEN CAR, IN THE ORDER OF ASSEMBLING

(12 Benches; Car No. 4; Fig. 5; Plates II. and XII.)

Consecutive Number	Quantity	Name of Piece	Piece Number Plates II. and XII.	Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate XII.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									The Cabinet Work, Trimmings etc., are prepared during the assembling of the pieces already described, and after the platforms and platform-hoods are attached (*See Table No. 38 and Plate X*) they are put in place, adjusted and secured much in the order of procedure here given, although in many cases several different pieces or parts are in hand at the same time	
66	1	**Upper-deck panel-ceiling** (Not. Ill.)	9038	Q. O.	..	.....	..	25 ft. 11¾ in. x 3 ft. 7 in. x ¼ in.	In 3 pieces, nailed and screwed to the upper-deck rafters with about 90 No. 6 x ⅝ in. steel screws	
167	2	**Side crown-moldings** (Figs. 593, 594)	9101	A.	..	.....	..	.....	Screwed to the upper-deck rafters with 54 No. 12 x 1¼ in. bronze screws	Molding machine
168	2	**End crown-moldings** (Figs. 593, 594)	9102	A.	..	.....	..	.....	Screwed to the upper-deck end-furring (7027) with 8 No. 12 x 1¼ in. bronze screws	Molding machine
169	5	**Head-lining joint-moldings** (Figs. 593, 594)	9.03	A.	..	.....	..	.....	Screwed to the upper-deck rafters with 20 No. 6 x 1 in. bronze screws	Molding machine
170	2	**Advertising rack-rails with facia** (Figs. 593, 594	9050	A.	..	.....	..	.....	Screwed to the side top-rails (6018) Fig. 163, Plate VI., with 20 No. 12 x 1¾ in. bronze screws	Molding machine
171	2	**Lower-deck panel-ceilings** (Not Ill.)	9039	Q. O.	..	.....	..	25 ft. 8 in. x 1 ft. 3½ in. x ¼ in.	In 3 pieces each, nailed and screwed to the ventilator bottom-rail and lower-deck rafters with about 80 No. 6 x ⅝ in. steel screws	
172	2	**Side-ceiling moldings** (Figs. 593, 594)	9110	A.	..	.....	..	.....	Screwed to the ventilator bottom-rail with 38 No. 12 x 1¼ in. bronze screws	Molding machine
173	2	**Upper advertising-moldings** (Figs. 593, 594)	9113	A.	..	.....	..	.....	Screwed to the lower-deck rafters with 54 No. 6 x 1 in. bronze screws	Molding machine
174	6	**Side-ceiling joint-moldings** (Figs. 593, 594)	9111	A.	..	.....		.....	Nailed to the lower-deck rafters	Molding machine
175	4	**Side-ceiling end-moldings** (Fig. 591)	9112	A.	..	.....	..	.....	Steamed and bent to shape on a former and nailed to the end top-rail	Molding machine
176	4	**Ventilator corner-moldings** (Figs. 593, 594)	9107	A.	..	.....	..	.....	Nailed to the ventilator corner-posts	Molding machine
177	20	**Ventilator-post facia** (Figs. 593, 594)	9109	A.	..	.....	..	.....	Nailed to the ventilator side-posts	Molding machine
178	2	**Ventilator bottom-rail facia** (Figs. 593, 594)	9104	A.	..	.....	..	.....	Nailed to the face of the ventilator bottom-rail	Molding machine
179	2	**Ventilator bottom-rail facia molding** (Figs. 593, 594)	9105	A.	..	.....	..	.....	Nailed through the ventilator bottom-rail facia (Con. No. 178) to the ventilator bottom-rail	Molding machine
180	2	**End top-rail facia** (Figs. 556, 594)	9106	A.	..	.....	..	.....	Screwed to the end top-rail with 8 No. 12 x 1¼ in. bronze screws	Molding machine
181	4	**Bulkhead-panel rosettes** (Fig. 563)	9120	A.	..	.....	..	.....	Screwed to the end sub top-rail (6012) with 8 No. 12 x 1¾ in. bronze screws	Lathe
182	4	**Bulkhead-panels** (Fig. 568)	9043	A.	..	.....	..	.....	Secured with	Panel raiser
183	8	**Bulkhead-panel beads** (Figs. 593, 594)	9122	A.	..	.....	..	.....	Nailed to the corner and false end-posts	Molding machine
184	..	**14 Ventilator side-sashes** (Fig. 526)	9001	A.	..	.....	..	.....	Composed of	
184a	14	**Top-rails** (Fig. 538)	9002	A.	..	.....	..	2 ft. 6⅛ in. x 1¼ in. x ¾ in.	All joints mortised, tenoned and glued, each piece having one edge rabbeted ½ in. x ¼ in. to receive the glass. *Note.*—The lengths of rails with tenons are from end to end of the sash	Variety machine, end tenoner and hollow-chisel mortiser
185	14	**Bottom-rails** (Fig. 539)	9003	A.	..	.....	..	2 ft. 6⅛ in. x 1½ in. x ¾ in.		
186	28	**Stiles** (Fig. 532)	9004	A.	..	.....	..	8½ in. x 1¾ in. x ¾ in.		
187	14	**Chipped-glass** (Not Ill.)	9207	....	..	.....	..	2 ft. 3 in. x 6 in.	Set in putty all round and secured with	
188	56	**Glass-beads** (Figs. 593, 594)	9125	A.	..	.....	..	.....	Nailed to the sash	Molding machine
188a	..	**8 Ventilator side-sashes** (Fig. 526)	9001	A.	..	.....	..	.....	Composed of:—	
188b	8	**Top-rails** (Fig. 538)	9002	A.	..	.....	..	1 ft. 7 9-16 in. x 1¼ in. x ¾ in.	All joints mortised, tenoned and glued, each piece having one edge rabbeted ½ in. x ¼ in. to receive the glass	Variety machine, end tenoner and hollow-chisel mortiser
188c	8	**Bottom-rails** (Fig. 539)	9003	A.	..	.....	..	1 ft. 7 9-16 in. x 1¼ in. x ¾ in.		
188d	16	**Stiles** (Fig. 532)	9004	A.	..	.....	..	8½ in. x 1¾ in. x ¾ in.		
188e	8	**Chipped-glass** (Not Ill.)	9207	....	..	.....	..	1 ft. 4½ in. x 6 in.	Set in putty all round and secured with	
188f	32	**Glass-beads** (Figs. 593, 594)	9125	A.	..	.....	..	.....	Nailed to the sash	Molding machine
189	44	**Ventilator-sash pivots** (Fig. 575)	9509	Bz.	..	.....	..	.....	Screwed to above sash stiles with 88 No. 6 x ⅝ in. bronze screws and inserted in corresponding holes in the ventilator side and side-corner posts	
190	20	**Ventilator-sash steps** (Fig. 576)	9510	Bz.	..	.....	..	.....	Screwed to the ventilator side and side-corner-posts with 40 No. 6 x ⅝ in. bronze screws	
191	..	**6 Bulkhead sashes** (Fig. 530)	9009	A.	..	.....	..	.....	Composed of:—	
191a	6	**Top-rails** (Fig. 536)	9010	A.	..	.....	..	1 ft. 10¼ in. x 2¾ in. x ½ in.	All joints mortised, tenoned and glued, each piece having one edge rabbeted 5-16 in. x ¼ in. to receive the glass	Variety machine, end tenoner and hollow-chisel mortiser
192	6	**Bottom-rails** (Fig. 537)	9011	A.	..	.....	..	1 ft. 10½ in. x 3⅜ in. x ½ in.		
193	12	**Stiles** (Fig. 531)	9012	A.	..	.....	..	2 ft. 9¾ in. x 2 5-16 in. x ½ in.		
194	6	**"Elmira" plate-glass** (Not Ill.)	9208	....	..	.....	..	2 ft. 4 in. x 1 ft. 6 in.	Set in putty all round and secured with	
194a	24	**Glass-beads** (Figs. 593, 594)	9125	A.	..	.....	..	.....	Nailed to the sash	Molding machine
195	6	**Sash top-lifts** (Fig. 577)	9511	Bz.	..	.....	..	.....	Screwed to the sash top-rails with 6 No. 7 x ⅝ in. steel screws	
196	6	**Sash leather-lifts** (Fig. 578)	9513	....	..	.....	..	.....	Secured with	
197	6	**Sash leather-lift plates** (Fig. 578)	9512	Bz.	..	.....	..	.....	Screwed to the sash bottom-rails with 12 No. 7 x ⅝ in. bronze screws	
198	12	**Anti-rattle sash-plates and springs** (Fig. 579)	9514	Bz.	..	.....	..	.....	Stephenson pattern, screwed to the sash stiles with 24 No. 4 x ⅜ in. bronze screws	
199	4	**Corner-post corner-moldings** (Figs. 593, 594)	9119	A.	..	.....	..	.....	Screwed to the corner-posts with 32 No. 4 x ⅝ in. bronze screws	Molding machine
200	4	**Bulkhead-panel sills** (Figs. 560, 594)	9123	A.	..	.....	..	.....	Nailed to the inside end-belt-rail (6007)	Molding machine
201	..	**6 Ventilator sign-sashes** (Fig. 527)	9013	A.	..	.....	..	.....	Composed of:—	
201a	6	**Top-rails** (Fig. 540)	9014	A.	..	.....	..	2 ft. 7⅝ in. x 1 9-16 in. x ¾ in.	All joints mortised, tenoned and glued, each piece having one edge rabbeted ½ in. x ¼ in. to receive the glass	Variety machine, end tenoner and hollow-chisel mortiser
202	6	**Bottom-rails** (Fig. 541)	9015	A.	..	.....	..	2 ft. 7⅝ in. x 2⅛ in. x ¾ in.		
203	12	**Stiles** (Fig. 533)	9016	A.	..	.....	..	9¼ in. x 2½ in. x ¾ in.		

TABLE NO. 40—*Continued*

Consecutive Number	Quantity	Name of Piece	Piece Number Plates II. and XII.	Material See Plates I and II.	Details: Quantity	Details: Name	Reference Letter Plate XII.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
204	6	**Ground-glass** (Not Ill.)	9209	----	..	.....	..	2 ft. 3 in. x 6 in.	Set in putty all round and secured with	
205	24	**Sign-sash glass-beads** (Figs. 593, 594)	9126	A.	..	.....	..	.....	Nailed to the sash	Molding machine
206	12	**Ventilator sign-sash latches** (Fig. 572)	9508	Bz.	..	.....	..	.....	Screwed to the sign-sash bottom-rails with 48 No. 7 x ¾ in. bronze screws	
207	12	**Ventilator sign-sash keepers** (Fig. 574)	9508	Bz.	..	.....	..	.....	Screwed to the ventilator bottom-rail roof-molding with 24 No. 7 x ¾ in. bronze screws	
208	6	**Side sign sash moldings** (Figs. 593, 594)	9124	A.	..	.....	..	.....	Screwed to the ventilator top-rail (7001) with 24 No. 7 x 1 in. bronze screws	Molding machine
209	..	**2 Ventilator end-sign-sashes** (Fig. 528)	9017	A.	..	.....	..	.....	Composed of:—	
209a	2	**Top-rails** (Fig. 529)	9018	A.	..	.....	..	3 ft. 11¼ in. x 1¼ in. x ¾ in.	All joints mortised, tenoned and glued, each piece having one edge rabbeted ½ in. x ¾ in. to receive the glass	Variety machine, end tenoner and hollow-chisel mortiser
210	2	**Bottom-rails** (Fig. 529a)	9019	A.	..	.....	..	3 ft. 11¼ in. x 1¼ in. x ¾ in.		
211	4	**Stiles** (Fig. 534)	9020	A.	..	.....	..	9½ x 2¼ in. & 2¼ in. x ¾ in.		
212	2	**Mullions** (Fig. 535)	9021	A.	..	.....	..	9⅞ in. x 2 in. x ⅝ in.		
212a	4	**Ground-glass** (Not Ill.)	9209	----	..	.....	..	1 ft. 9⅛ in. x 7 in.	Set in putty all round and secured with	
212b	14	**Sign-sash glass-beads** (Figs. 593, 594)	9126	A.	..	.....	..	.....	Nailed to the sash	Molding machine
213	2	**Ventilator end-sign-sash holders** (Fig. 558)	9036	A.	..	.....	..	9½ in. x 2 1-16 in. x ¾ in.	With one edge rabbeted to fit the sash stile, and	Variety machine
----	2	**Ventilator end-sign-sash holders** (Fig. 558)	9036	A.	..	.....	..	9⅛ in. x 1⅝ in. x ¾ in.	Screwed to the ventilator end-corner-posts (7004) with 8 No. 12 x 1½ in. bronze screws	Variety machine
213a	2	**Ventilator sign-sash latches** (Fig. 572)	9508	Bz.	..	.....	..	.....	Screwed to the sign-sash stile with 8 No. 7 x ¾ in. bronze screws	
214	2	**Ventilator sign-sash keepers** (Fig. 573)	9508	Bz.	..	.....	..	.....	Screwed to the sign-sash holders with 4 No. 7 x ¾ in. bronze screws	
215	4	**Bulkhead sash-guards** (Not Ill.)	6028	P.	..	.....	..	6 ft. 4¼ in. x 1 ft. 3¾ in. x ⅛ in.	Screwed under the seats to the false-end and end-center posts with 48 No. 10 x 1 in. steel screws	
216	4	**Electric-wire furring** (Not Ill.)	6029	A.	..	.....	..	1 ft. 3½ in. x 2 in. x 1¼ in.	Nailed to the end-bulkheads (6001)	
217	12	**Rubber sash-rests** (Not Ill.)	9040	----	..	.....	..	3¼ in. x 1 in. x ⅜ in.	Nailed to the bottom false-sill	
218	..	**8 Reversible slat-seats** (Fig. 548)	9028	A.	..	.....	..	.....	Composed of:—	
218a	16	**Seat-rails** (Fig. 550)	9029	A.	..	.....	..	6 ft. 11⅞ in. x 1 in. x 1⅝ in.	And	Molding machine
219	64	**Seat-slats** (Fig. 552)	9030	A.	..	.....	..	6 ft. 11⅞ in. x 1⅝ in. x ⅝ in.	Screwed to	Molding machine
220	32	**Reversible seat-brackets** (Fig. 570)	9501	M. I.	..	.....	..	.....	With 64 No. 10 x 1 in. and 256 No. 10 x ⅝ in. steel screws; these reversible slat-seats are secured in place by the seat-rails being bolted to the side-post seat-end iron-panels (6502), Fig. 188, Plate VI., through holes (e) with	
221	32	**Seat-bolts** (Fig. 567)	9507	W. I.	..	.....	..	.....	With beveled washers and nuts	
222	..	**4 Bulkhead slat-seats** (Fig. 549)	9031	A.	..	.....	..	.....	One on each side of the bulkheads, composed of	
222a	4	**Front-rails** (Fig. 550)	9032	A.	..	.....	..	6 ft. 11⅞ in. x 1⅝ in. x 1⅝ in.		
223	4	**Back-rails** (Fig. 551)	9033	A.	..	.....	..	6 ft. 11⅞ in. x 2 in. x 1⅝ in.	And	Molding machine
224	32	**Seat-slats** (Fig. 552)	9034	A.	..	.....	..	6 ft. 11⅞ in. x 1⅜ in. x ⅝ in.	Screwed to	
225	16	**Bulkhead seat-brackets** (Fig. 571)	9502	M. I.	..	.....	..	.....	With 32 No. 10 x 1 in. and 128 No. 10 x ⅝ in. steel screws; the back-rails are screwed to the corner-posts with 8 No. 16 x 3 in. steel screws, and the seats are further secured by the front-rails being bolted to the corner-post seat-end iron-panels (6501), Fig. 187, Plate VI., through holes (e) with	
225a	8	**Seat-bolts** (Fig. 567)	9507	W. I.	..	.....	..	.....	With beveled washers and nuts	
226	6	**Bulkhead seat-legs** (Fig. 561)	9035	A.	..	.....	..	1 ft. 7 in. x 1 9-16 in.	Adjusted to the front seat-rails and the flooring, two to each platform-seat and one to each inside-seat	Lathe
227	..	**8 Reversible seat-backs** (Fig. 545)	9022	A.	..	.....	..	.....	Composed of:—	
227a	16	**Rails** (Fig. 546)	9023	A.	..	.....	..	6 ft. 2⅛ in. x 2½ in. x 1 in.	All joints mortised, tenoned and glued, each rail having one edge grooved to receive the panels, they are secured in position with	Molding machine Variety machine
228	16	**End-rails** (Fig. 542)	9024	A.	..	.....	..	1 ft. 3¼ in. x 2½ in. x 1 in.		Beading machine
229	24	**Parting-rails** (Fig. 543)	9025	A.	..	.....	..	1 ft. 3¼ in. x 1¾ in. x 1 in.		
230	96	**Panels** (Fig. 544)	9026	A.	..	.....	..	1 ft. 4⅛ in. x 4⅛ in. x 7-16 in.		
231	16	**Reversible seat-back arms** (Fig. 564)	9503	Bz.	..	.....	..	.....	Screwed to the seat end-rails with 8 No. 12 x 1 in. bronze screws; the arms being pivoted to the side-posts (6003) through bolt-holes (h) Fig. 178, Plate VI., with	
232	16	**Reversible seat-back arm-plates** (Fig. 566)	9504	Bz.	..	.....	..	.....	And	
233	16	**Reversible seat-back arm-pivots and nuts** (Fig. 566)	9505	Bz.	..	.....	..	.....	Which also hold the pillar-handle middle-sockets (6512). *See Con. No. 43, Table No. 34*	
234	32	**Seat-back strike-rubbers** (Not Ill.)	9041	----	..	.....	..	⅝ in. diam., 11-16 in. long	Let into the rails, varnished and nailed	
235	4	**Bulkhead seat-backs** (Fig. 547)	9027	A.	..	.....	..	6 ft. 8¼ in. x 9 in. x 1 in.	One on each side of the bulkheads, screwed to the end-center and false end-posts with 32 No. 12 x 1¾ in. steel screws	Beading machine
236	8	**Bulkhead seat-arms** (Fig. 569)	9506	Bz.	..	.....	..	.....	Bolted and screwed to the bulkhead-seat front-rails (9032) with 8 bolts 2½ in. x ¼ in. and 8 No. 18 x 1¾ in. bronze screws, and bolted and screwed to the corner-posts with 4 bolts 5¼ in. x 5-16 in. each with 2 bronze nuts, and 8 No. 18 x 1¾ in. and 8 No. 14 x 1½ in. bronze screws	
237	14	**Spring-roller shades** (Not Ill.)	9042	----	..	.....	..	7 ft. 1 in. x 2 ft. 5¼ in.	"Pantasote," with "Hartshorn" rollers and "Acme" fixtures, hung in sockets screwed in pockets (f) of the side-posts with 56 No. 4 x ½ in. steel screws, and	
----	4	**Spring-roller shades** (Not Ill.)	9042	----	..	.....	..	7 ft. 1 in. x 3 ft. 4¾ in.	As above, screwed to the end side and corner-posts with 16 No. 4 x ½ in. steel screws, and	
----	4	**Spring-roller shades** (Not Ill.)	9042	----	..	.....	..	3 ft. 6 in. x 1 ft. 9 in.	As above, screwed to the false-end and end center-posts with 16 No. 4 x ½ in. steel screws	
238	16	**Side-post caps** (Fig. 555)	9116	A.	..	.....	..	.....	With holes for electric push-buttons, screwed to the face of the side-posts with 64 No. 6 x 1 in. bronze screws	Molding machine and router
239	4	**Center-post caps** (Fig. 553)	9117	A.	..	.....	..	.....	Screwed to the face of the end center-posts with 20 No. 9 x 1 in. bronze screws	Molding machine
240	4	**False-end-post caps** (Fig. 554)	9118	A.	..	.....	..	.....	Screwed to the face of the false-end-posts with 20 No. 9 x 1 in. bronze screws	Molding machine
241	6	**End top-valance lights** (Not Ill.)	9207	----	..	.....	..	.....	Chipped glass, secured to the end top-valances with	

242	16	**Side transom-glass beads** (Figs. 593, 594)	9127	A.	"	"		And		Molding machine
243	8	**Center transom-glass beads** (Figs. 593, 594)	9128	A.	"	"		Nailed to the end top-valances. *See Con. No. 40, Table No. 34*		Molding machine
244	2	**Transom-glass bottom-molding** (Figs. 593, 594)	9129	A.	"	"		Nailed all along the bottom inside edge of the end top-valance		Molding machine
245	2	**Platform electric-light rosettes** (Fig. 562)	9131	A.	"	"	3 in. x ⅞ in.	Screwed to the end top-valance with 4 No. 7 x ¾ in. steel screws		Lathe
246	2	**Trolley switch-blocks** (Fig. 559)	8012	A.	"	"	10⅝ in. x 8½ in. x 3½ in.	Screwed to the platform-hood rafters with 12 No. 12 x 1¼ in. bronze screws		
247	1	**Electric-battery box** (Fig. 557)	8011	P.	"	"	7 in. x 6½ in. x 6½ in.	Which with		
248	4	**Electric dry-batteries** (Not Ill.)	8017	----	"	"		Shown at Fig. 507, Plate XI., is screwed to the floor under the inside end seat with 2 No. 12 x 1¼ in. steel screws, and covered with a lid screwed down with 2 No. 8 x 1 in. steel screws		
249	2	**Electric-bells** (Not Ill.)	8014	----	"	"		Shown at Fig. 498, Plate XI., screwed to the end top-valance with 4 No. 7 x ⅞ in. steel screws		
250	2	**Electric-switches** (Not Ill.)	8015	----	"	"		Shown at Fig. 514, Plate XI., screwed to the end top-valance with 4 No. 8 x 1 in. bronze screws		
251	16	**Electric push-buttons** (Not Ill.)	8016	----	"	"		Shown by Fig. 521, Plate XI., secured in the holes of the side-post caps (9116), Fig. 555		
252	2	**Signal-bells** (Fig. 586)	8010	Bz.	"	"		Screwed to the platform-hood rafters with 8 No. 12 x 1 in. bronze screws		
253	8	**Bell-cord bushings** (Figs. 588, 589)	8011	Bz.	"	"		Screwed to the bulkhead-panel rosettes and the end top valances with 24 No. 4 x ½ in. bronze screws		
254	2	**Bell-cord hooks** (Fig. 590)	8012	Bz.	"	"		To connect the bell-cord to the signal-bells		
255	2	**Bell-cord end-fasteners** (Fig. 592)	8013	Bz.	"	"		Screwed to the platform-hood bows (7020) with 4 No. 12 x 1 in. bronze screws, to secure the end of the bell-cord		
256	2	**Corner-post trolley-steps** (Not Ill.)	6527	C. I.	"	"		Shown by Fig. 493, Plate IX., screwed to diagonally opposite corner-posts with 6 No. 14 x 1¾ in. steel screws		
257	1	**Register-block** (Fig. 565)	9037	A.	"	"		Screwed inside at one end of the car to the end center-posts with 4 No. 12 x 2½ in. bronze screws, for the fare-register to be fastened to		Variety machine
258	2	**Register-rods** (Not Ill.)	9516	W. S.	"	"		Held by		
259	16	**Register-rod brackets** (Fig. 561)	9517	Bz.	"	"		Screwed to the advertising-rack rail (9050) and side-post caps with 32 No. 12 x 1½ in. bronze screws, and operated by		
260	20	**Register-rod levers** (Fig. 580)	9533	Bz.	"	"		With the leather pull straps and secured to the register-rods with set-screws		
261	4	**Register-rod sleeves** (Fig. 582)	9519	Bz.	"	"		And		
262	4	**Register-rod bushings** (Fig. 585)	9520	Bz.	"	"		Screwed to the end sub-top-rail (6019) with 32 No. 9 x ½ in. bronze screws		
263	4	**Register-rod loose collars** (Fig. 587)	9521	Bz.	"	"		Put on the ends of the register-rod between the end of the car body and the levers on the platform		
264	2	**Register operating-cranks** (Fig. 583)	9523	Bz.	"	"		Adjusted to the register-rod and secured with the set-screw, to operate the register		

During the assembling of the different pieces and parts of the Cabinet Work, Trimmings, etc., the painting of the cars is proceeded with from the point reached in Table No. 36, Con. No. 105, as follows:—7th day: Sanded with No. 1½ paper and given a coat of color; 8th day, a coat of finishing color; 9th day, second coat of finishing color to dry with a little gloss; 10th day, stripe and letter; 11th day, A coat of Ry. coach finishing varnish on the entire exterior. Special parts are painted as follows:—Exterior of the sills and dasher receive 3 coats of flat color and one of gloss color applied on 4 consecutive days; Floors, steps and toe-guards, light gray; Dasher-posts, 2 coats color and varnish; Buffers, 2 coats Indian red; Iron work under car, metallic red; Sash sign-, black block letter-; Inside finish, natural wood with a coat of white shellac, one of Ry. coach rubbing and one of Ry. coach finishing varnish left in gloss, 24 hours between each coat.

Number of Distinctive Pieces	99	(Column 1)
Total Number of Pieces	1182	(" 2)
Number of Bolts	12	(" 6 and 10)
Number of Screws, about	1668	(" 6 and 10)
Number of Nails	(?)	
Total	2862	+

A THREE-YEAR COMPARISON OF CABLE, ELECTRIC AND HORSE TRACTION IN NEW YORK CITY

The addition of the detailed earnings and operating expenses for the year ending June 30, 1900, to the two previous statements of the Metropolitan Street Railway Company of New York, which that company has generously allowed to be made public in these columns, makes a three-year record of the comparative cost and profits of cable, electric and horse railway operation of the largest city transportation system in the world, the value of which would be hard to overestimate. The total track mileage of the system during the last three years has remained practically unchanged. All three motive powers are used on the best streets and for the same kind of traffic, and the traffic density on the cable and electric lines is not greatly different. Comparisons could not possibly be made to better advantage except that it will, of course, be most interesting to know, a year or two hence, what is the actual cost of electric operation on the present cable system as compared with that of the cable, which electricity is about to replace.

It will be seen that there is little or no change in the conditions on the cable lines during the three years. The car mileage is almost the same, and the gross receipts, the operating expenses and the net earnings are surprisingly alike. The net earnings per car mile, however, are on a slightly decreasing scale, the range being from 18 cents in 1898 to 17.10 cents in 1900.

The horse railway car mileage has decreased from 15,994,912 miles in 1898 to 9,812,031 miles in 1900. The gross receipts per car mile have shown little change, but there has been a steady fall in net from 9.48 cents per car mile to 6.82 cents. Examination of the detailed report shows that this has been caused chiefly by an increase in the cost of provender and material with the much higher prices of the last eighteen months.

It is, of course, in the electric system that the greatest changes have taken place. The car mileage has increased from 7,110,090 in 1898 to 24,968,196 in 1900. During the same period the total passenger receipts were increased from $1,918,873, an average of 29.99 cents per car mile, to the enormous total of $8,125,112, an average of 32.54 cents per car mile. The operating expenses have increased from 10.23 cents per car mile to 13.16 cents; but the net earnings (from passenger operation) have increased from 16.76 cents to 19.38 cents, a sum equal to the gross of many roads, and a very satisfactory showing.

Examination of the detailed operating ex-

penses shows an increase in each year in the main divisions as follows:

	1898	1899	1900
Maintenance of way	.33	.68	.81
Maintenance of equipment	.83	1.17	1.41
Power	1.70	1.77	1.99
Transportation	6.15	7.06	7.29
General expenses	1.22	1.27	1.66
Total	10.23	11.95	13.16

Some increase in these departments might readily have been expected because of the general condition of aging of plant and equipment, but there are two other elements which must not be lost sight of in making these comparisons. The first is that prices on coal, iron, steel and other material have been constantly increasing during the past three years. The other is that the "electric car mile" of 1900 is a very different thing from that of 1899 or 1898. due to the introduction, in the last two years, of longer cars, having much larger seating capacity. Such an increase in car capacity is inevitably felt more or less in every department of operation, and it is, on the whole, rather surprising that the increase in cost per car mile is not greater than is shown by the above figures.

The net (passenger) profits last year of the three different motive powers applicable to interest and dividend payments are as follows:

COMPARATIVE PROFITS IN 1900

	Per car mile	Percentage profits to gross receipts
Electric	19.38	59.5
Cable	17.10	49.0
Horse	6.82	26.4

It may be stated as an interesting fact that the horse railway portion of the Metropolitan Street Railway system, as it exists to-day, is a heavy financial drag upon the mechanical system, and it may be readily inferred, not only how important it is that horse traction should be replaced by some improved form of motive power, but what a tremendous future increment of earning power will come to this company when its horse railway mileage, now nearly half the entire system, shall be converted.

The great economy of the electric system over either cable or horses is but partly expressed by the accompanying tables and the above statements. The car mile unit is different in each case. The horse car will seat only sixteen to twenty passengers, the cable car about twenty-eight passengers, while nearly all the electric cars now in use will seat from thirty to fifty passengers. It will, therefore, be fairer in some respects to compare the three systems by the cost per passenger carried. This cost amounts to 2.02 cents for the electric cars, 2.55 cents for the cable cars (with greater density of travel than is found on any of the electric lines), and 3.67 cents for horse cars (with less average density of travel than on either cable or electric cars).

There is still another greater advantage of electricity over the cable or horse system, which cannot be expressed by figures, but is none the less reflected in increased earnings of a system, both gross and net. The electric system is far more "flexible" than is the cable system; a given number of cars can give a much larger service to the public through their greater speed and the ability which they have to make up lost time; paralysis of one or more complete lines, or of the system, is far less frequent than with the cable sytem; and, in short, a system can be handled from the operator's standpoint with far less friction and worry.

Taken as a whole, the Metropolitan system earned 31.63 cents per car mile in the year ending June 30, 1900, as against 29.70 cents in 1897, and its net profits from passenger operation were 16.13 cents as against 13.87. The percentages of operating expenses to gross receipts for the three motive powers and for the entire system have been as follows during the past three years:

PERCENTAGE OPERATING EXPENSES TO GROSS RECEIPTS

	1898	1899	1900
Cable	47.8	50.8	51.0
Electric	37.9	38.3	40.5
Horse	65.3	69.8	73.6
Total	53.3	49.4	49.0

The figures given in the accompanying table are for passenger receipts and operation only, irrespective of other operating receipts, fixed charges, etc. It may be interesting to present herewith a complete financial statement of the operation of the Metropolitan system for the last three years. In this statement the receipts from sources other than passengers include receipts from advertising, dividends on stock of other companies held in the treasury, income from rental of offices in the power station and other buildings owned by the company, etc.; while the operating expenses shown here are slightly larger than those in the accompanying table because of items covering cost of caring for office buildings and other real estate and a few other small charges.

GENERAL OPERATING REPORT

Earnings from all sources	$11,076,021	$13,525,524	$15,073,535
Operating expenses	5,620,484	6,408,711	7,104,607
Earnings from operation	5,455,537	7,116,813	7,968,928
Fixed charges	3,609,966	4,477,757	4,608,768
Surplus for dividends	1,845,571	2,639,056	3,360,160
Dividends paid (7 per cent)	1,500,000	2,471,675	3,145,891
Surplus over dividends	345,570	167,381	214,269

ITEMS.	Total					
	Amount			Per Car Mile		
	98	1899	1900	1898	1899	1900
GENERAL EXHIBIT						
Total passenger receipts	4,695	12,819,712	14,355,406	29.70	30.70	31.63
Passenger operating expenses	6,127	6,342,073	7,034,033	15.83	15.18	15.50
Earnings from passenger operation	8,568	6,477,639	7,321,373	13.87	15.50	16.13
OPERATING EXPENSES IN DETAIL						
MAINTENANCE OF WAY						
1 Repairs roadbed—track, labor	6,528	129,499	158,220	.34	.31	.35
2 " " material	1,117	23,370	45,065	.04	.06	.10
3 " " steel rails	6,859	1,114	*1,220	....	....	....
4 " " switches, castings, spikes,	6,804	32,247	39,232	.05	.08	.08
5 " " ties and timber	6,739	1,854	2,494	....	....	....
6 Repairs overhead and underground construc	1,731	105,389	124,078	.25	.25	.27
7 Renewals of cable	6,391	239,481	262,992	.54	.57	.58
8 Tube cleaners	6,988	42,642	54,927	.05	.10	.12
9 Oilers	6,720	41,511	42,108	.12	.10	.10
10 Gearsmen and splicers	6,240	21,339	20,397	.06	.05	.05
11 Repairs of buildings	6,182	33,331	50,525	.06	.08	.11
12 Removal of snow and ice, and street cleanin	6,725	67,322	44,422	.08	.16	.10
Total	6,024	739,099	843,239	1. 0	1.77	1.86
MAINTENANCE OF EQUIPMENT						
13 Repairs of cars and vehicles	6,904	263,463	318,521	.45	.63	.71
14 " " electrical or cable equipment of ca	6,247	127,701	189,839	.21	.31	.42
17 " " tools and machinery	6,195	4,610	3,326	....	.01	....
Total	6,345	395,774	511,686	.66	.95	1.13
POWER						
15 Repairs of steam plant	6,197	27,543	36,462	.05	.07	.08
16 " " electrical or cable plant	6,221	12,293	18,376	.04	.03	.04
18 " " harness	6,404	15,240	16,868	.05	.04	.04
19 Stable equipment, supplies. etc	6,805	9,349	9,363	.04	.02	.02
20 Renewals of horses	6,020	24,925	27,000	.19	.06	.06
21 Horse shoeing	6,981	66,264	57,390	.24	.16	.12
22 Cost of provender	6,624	397,392	381,181	1.32	.95	.84
23 " " feedmen—wages	6,198	31,014	27,115	.12	.08	.06
24 " " removing manure	6,084	6,575	6,442	.02	.01	.01
27 Hostlers, hitchers and stable help	6,134	290,163	244,516	1.07	.70	.54
28 Engineers, firemen and power service	6,163	127,822	160,502	.25	.31	.35
32 Fuel, power houses	6,381	300,883	377,068	.45	.72	.85
33 Light and other supplies at power houses	6,900	29,797	37,322	.06	.07	.08
34 Water tax	6,754	55,374	65,669	.11	.13	.14
Total	6,867	1,394,634	1,465,273	3.95	3.34	3.23
TRANSPORTATION						
25 Conductors, drivers, gripmen and motorme	6,151	2,572,756	2,800,137	6.33	6.16	6.18
26 Inspectors, starters switchmen, etc	6,204	402,051	405,896	.89	.96	.89
29 Car house exp. watchmen, car cleaners, oile	6,457	175,882	210,929	.36	.42	.46
30 Car service—car lighting	6,059	45,425	52,454	.14	.11	.11
31 " " oil, waste, etc	6,281	35,198	47,612	.07	.08	.10
Total	6,153	3,231,312	3,517,027	7.81	7.73	7.74
GENERAL EXPENSES						
35 Salaries of officers and clerks	6,348	93,262	100,624	.24	.22	.22
36–40 Injuries and damages	6,229	212,154	277,498	.78	.51	.61
41–48 Other general expenses	6,162	275,837	318,686	.79	.66	.70
Total	6,738	581,253	696,808	1.81	1.39	1.53
Total operating expenses	6,127	6,342,073	7,034,033	15 83	15.18	15.49
Car mileage run	6,406	41,760,856	45,390,318	....	....	....

* Credit balances.

RECEIPTS AND EXPENSES OF THE METROPOLITAN STREET RAILWAY COMPANY, OF NEW YORK,

For the Years Ending June 30, 1898, June 30, 1899, and June 30, 1900,

SHOWING THE RELATIVE COSTS AND PROFITS OF CABLE, ELECTRIC AND HORSE RAILWAY OPERATION

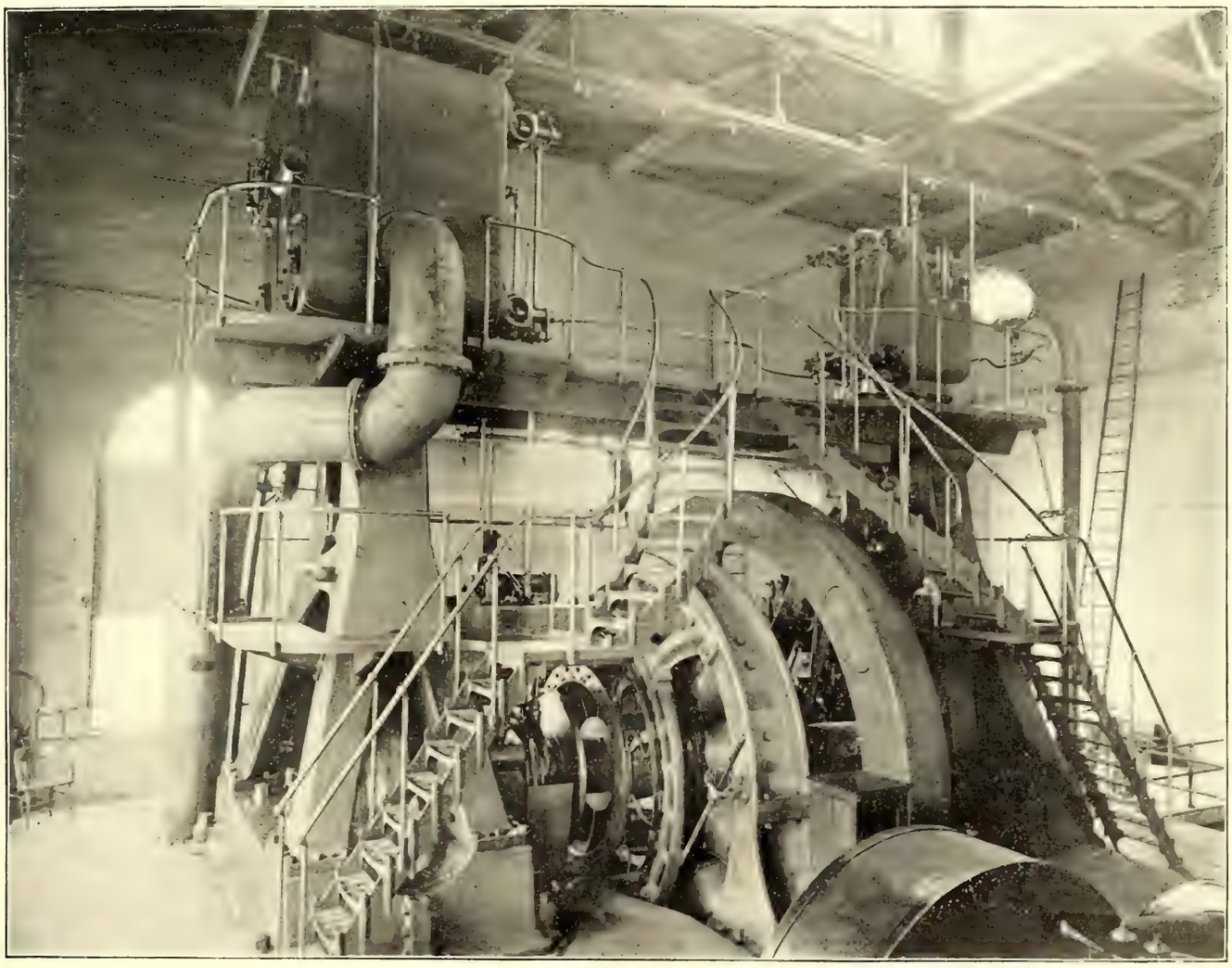
ITEMS.	Cable						Electric						Horse						Total					
	Amount			Per Car Mile			Amount			Per Car Mile			Amount			Per Car Mile			Amount			Per Car Mile		
	1898	1899	1900	1898	1899	1900	1898	1899	1900	1898	1899	1900	1898	1899	1900	1898	1899	1900	1898	1899	1900	1898	1899	1900
GENERAL EXHIBIT																								
Total passenger receipts	4,130,225	3,690,615	3,698,672	34.42	35 43	34.86	1,918,873	6,043,538	8,125,112	26.99	31 23	32.54	4,375,597	3,085,559	2,531,622	27.35	25 72	25.80	10 424,695	12,819,712	14.355,406	29.70	30.70	31.63
Passenger operating expenses	1,970,486	1,874,422	1,884,723	16 42	18 00	17.76	727,406	2,312,682	3,286,544	10.23	11 95	13.16	2,858,235	2,154,969	1,862,766	17 87	17 96	18 98	5,556,127	6,342,073	7,034,033	15.83	15.18	15.50
Earnings from passenger operation	2,159,739	1,816,193	1,813,949	18.00	17.43	17.10	1,191,467	3,730,856	4,838,568	16.76	19 28	19 38	1,517,362	930,590	668,856	9 48	7 76	6.82	4,868,568	6,477,639	7.321,373	13 87	15.50	16 13
OPERATING EXPENSES IN DETAIL																								
MAINTENANCE OF WAY																								
1 Repairs roadbed—track, labor	41,447	44,894	37,630	.35	.43	.35	6,153	25,796	57,780	.09	.13	.23	72,928	58,810	62,810	.46	.49	.64	120,528	129,499	158,220	.34	.31	35
2 " " material	6,673	4,685	10,111	.06	.05	.09	*105	4,223	8,869	....	.02	.03	7,549	14.462	26,085	.05	.12	.26	14,117	23,370	45,065	.04	.06	.10
3 " " steel rails	200	375	*35	..	..	....	954	28	*266	.01	....	..	705	711	*919	....	....	....	1,859	1,114	*1,220	....	....	
4 " " switches, castings, spikes, etc	10,108	17,227	14,666	.08	.17	.14	3,128	10,083	19.983	.04	.05	.08	5,567	4,936	4,583	.03	.04	.04	18,804	32,247	39,232	05	.08	.08
5 " " ties and timber	287	14	75	....	....	.	148	746	702	...	....	....	2,304	1,093	1,717	.01	.01	.02	2,739	1,854	2.494	...	.	...
6 Repairs overhead and underground construction	80,787	82,411	88,582	.67	.79	84	5.779	22 978	35.495	08	.13	.14	165	. .				. .	86,731	105.389	124,078	.25	.25	.27
7 Renewals of cable	189,391	239,481	262,992	1.58	2.30	2 48													189,391	239,481	262,992	.54	.57	.58
8 Tube cleaners	11,758	11,824	11,216	.10	.11	.11	4,230	30,818	43.711	.06	.16	18							15,988	42,642	54,927	.05	.10	.12
9 Oilers	40,708	41,511	42,108	.34	.40	.40	12												40,720	41,511	42,108	.12	.10	.10
10 Gearsmen and splicers	21,240	21,339	20,397	.18	.20	.19													21,240	21,339	20,397	.06	.05	.05
11 Repairs of buildings	4,099	7,783	10,350	.03	.08	.10	821	11.853	16,516	.01	.06	.07	17,262	13.695	23,659	.10	.11	.24	22,182	33,331	50,525	.06	.08	.11
12 Removal of snow and ice, and street cleaning	15,328	17,045	14,968	.13	.16	.14	2,731	25,413	19,925	.04	.13	.08	9,666	24,864	10,159	.06	.21	.10	27,725	67,322	44,422	.08	.16	.10
Total	422,027	488,590	513,061	3.54	4.69	4.84	23,851	131,938	202,084	.33	.68	.81	116,145	118,572	128,095	.72	.99	1 30	562,024	739,099	843,239	1. 0	1.77	1.86
MAINTENANCE OF EQUIPMENT																								
13 Repairs of cars and vehicles	68,768	78,174	63,403	.57	.75	.60	28,687	134,339	197,873	.40	.69	.79	61,449	50,950	57,245	.38	.42	59	158,904	263,463	318,521	.45	.63	.71
14 " " electrical or cable equipment of cars	42,287	37,380	36,348	.35	.36	.34	29,952	90,320	153.490	.42	.47	.62	8	. ....		...	...	....	72,247	127,701	189,839	.21	.31	.42
17 " " tools and machinery	1,714	1,974	1,053	.01	.02	....	152	2,562	2,007	....	.01	....	328	74	266	...	...	....	2,195	4,610	3,326	...	.01	....
Total	112,770	117,528	100,804	.94	1.13	0.94	58,792	227,222	353,371	.83	1.17	1.41	61,784	51,024	57,511	.39	.42	.59	233,345	395,774	511,686	.66	.95	1.13
POWER																								
15 Repairs of steam plant	15,147	19,196	23,558	.13	19	.22	2,042	8,1 8	12,904	.03	.04	.05	9	.....	.....	....	....	....	17,197	27,543	36,462	.05	.07	.08
16 " " electrical or cable plant	12,395	9,252	10,363	.10	.09	.10	824	3,042	8,013	.01	.02	.04	3	... ..	.....	....	..	. ..	13,221	12,293	18,376	.04	.03	.04
18 " " harness	458	219	110	....	.	.	584	1,057	1,461	....	....	....	15,361	13,964	15,298	.10	.12	.15	16,404	15,240	16,868	.05	.04	.04
19 Stable equipment, supplies, etc	174	113	.. ...	...	....	....	424	642	808	....	....	....	12,206	8,594	8,555	.08	.07	.09	12,805	9,349	9,363	.04	.02	.02
20 Renewals of horses	550	250	.....	....	....	....	3.030	750	. . ..	.04	. ..	....	62,440	23,925	27,000	.39	.20	.27	66,020	24,925	27,000	.19	.06	.06
21 Horse shoeing	571	352	161	.	...	.	2.477	3,175	4,034	.03	.02	.02	80,933	62,737	53,191	.51	.52	.54	83,981	66,264	57,390	.24	.16	.12
22 Cost of provender	3,432	4,081	3,933	.03	.04	.04	14,010	15.575	20,120	.20	.08	.08	445,183	377,736	357,129	2.78	3.15	3 64	462,624	397,392	381,181	1.32	.95	.84
23 " " feedmen—wages	92	270	331	....	....	...	1,687	2,228	2,491	.02	.01	.01	40,419	28,516	24,293	.25	.24	.25	42,198	31,014	27,115	.12	.08	.06
24 " " removing manure	60	75	70	....	....	....	*85	*137	*154	....	....	....	7,109	6,637	6,526	.04	.06	.07	7,084	6,575	6,442	.02	.01	.01
27 Hostlers, hitchers and stable help	2,485	3,033	3.504	.02	.03	.03	12,795	15.847	18,137	.18	.08	.08	347,855	271,283	222,874	2 18	2.26	2.27	363,134	290,163	244,516	1.07	.70	.54
28 Engineers, firemen and power service	65,262	64,342	59,896	.54	.62	57	20,662	63,480	100,605	.29	.33	.40	240	.....	. ..	....	...	....	86,163	127,822	160,502	.25	.31	.35
32 Fuel, power houses	104,912	112,428	106,424	.88	1.08	1.00	51 015	188,455	270,644	.72	.98	1.08	455	.....	.....	....	....	....	156,381	300,883	377,068	.45	.72	.85
33 Light and other supplies at power houses	15,471	16,383	17,967	.13	.16	.17	5,370	13 414	19,355	.08	.07	.08	59	.....	.....	....	.. .	....	20,900	29,797	37,322	.06	.07	.08
34 Water tax	21,775	19,383	21,408	.18	.19	.20	5,842	27,300	37.438	.08	.14	.15	11,138	8,691	6,823	.07	.07	.07	38,754	55,374	65,669	.11	.13	.14
Total	242,784	249,577	247,727	2.02	2.39	2.33	120,675	342,974	495,856	1.70	1.77	1.99	1,023,408	802,082	721,690	6.40	6.69	7.35	1,386,867	1,394,634	1,465,273	3.95	3.34	3.23
TRANSPORTATION																								
25 Conductors, drivers, gripmen and motormen	711,630	652,262	661,602	5.93	6.27	6.24	353,127	1,083,104	1,442,676	4.97	5.60	5.79	1,156,395	837,390	695,859	7.23	6 98	7.10	2,221,151	2,572,756	2,800,137	6.33	6.16	6.18
26 Inspectors, starters switchmen, etc	143,512	142,125	137,990	1.20	1.36	1.30	50,292	166,515	202,834	.71	.86	.81	119,400	93,411	65,072	.74	78	.67	313,204	402,051	405,896	.89	.96	.89
29 Car house exp. watchmen, car cleaners, oilers, etc	36,820	37,848	39,177	.31	.36	.37	27,392	93,205	136 722	.39	.48	.54	63,245	44,829	35,029	.40	.37	36	127,457	175,882	210,929	.36	.42	.46
30 Car service—car lighting	39,227	33,814	38,642	.33	.33	.36	1,142	2,306	5,144	.02	.01	.02	11,690	9,305	8,667	.07	.08	.07	52,059	45,425	52,454	.14	.11	.11
31 " " oil, waste, etc.	12,932	11,634	11,433	.11	.11	.11	5,158	19,991	32,331	.07	.10	.13	7,191	3,574	3,849	.04	.03	.04	25,281	35,198	47,612	.07	.08	.10
Total	944,120	877,683	888,844	7.87	8 43	8.38	437,111	1,365,121	1,819,708	6 15	7.06	7.29	1,357,921	988,508	808,476	8.49	8.24	8.24	2,739,153	3,231,312	3,517,027	7.81	7.73	7.74
GENERAL EXPENSES																								
35 Salaries of officers and clerks	30,359	28,123	25,583	.25	.27	.24	11,051	35,831	53,461	.16	.19	.21	41,938	29,308	21,579	.26	.24	.22	83,348	93,262	100,624	.24	.22	.22
36-40 Injuries and damages	150,325	59.474	59,353	1.25	.57	.56	43.829	101,968	179,753	.61	.53	.72	79,076	50,711	38,392	.49	.42	.39	273,229	212,154	277,498	.78	.51	.61
41-48 Other general expenses	68,099	53,446	49,351	.57	.51	.47	32,100	107,628	182,311	.45	.56	.73	177.962	114,764	87,024	1.11	.96	.89	278,162	275,837	318,686	.79	.66	.70
Total	248,784	141,043	134,287	2.07	1.35	1 27	86,978	245.428	415,525	1.22	1.27	1.66	298,976	194.783	146,995	1 87	1 62	1.50	634,738	581,253	696,808	1.81	1.39	1.53
Total operating expenses	1,970,486	1,874,422	1,884,723	16.42	17.99	17 76	727,406	2,312,682	3,286,544	10 23	11.95	13.16	2,858,235	2,154,969	1,862,766	17.87	17.96	18.98	5,556,127	6,342,073	7,034,033	15 83	15.18	15.49
Car mileage run	11,991,404	10,416,079	10,610,091	....	....	....	7,110,090	19,347,978	24,968,196	....	....	....	15,994.912	11,996,799	9,812,031	....	....	....	35.096,406	41,760,856	45,390,318	....	....	....

* Credit balances.

SCIENCE: ENGINEERING: INVENTION

A 1500-HP Vertical Engine at Portland, Maine

A new unit of power has recently been installed in the Forest Avenue power house of the Portland Railroad Company, consisting of a 1500-hp, vertical, cross-compound, Rice & Sargent engine, direct-connected to a 1050-kw General Electric railway generator. The engine has cylinders 28 ins. and 50 ins. in diameter by 42-in. stroke, and runs at 100 r. p. m. with 120 lbs. boiler pressure. The piston rods extend as tail rods through the heads of the cylinders; the receiver between the cylinders is cylindrical, extending across the frame, and mounted behind it, as shown in the illustration; the exhaust pipe curves around the frame, and passes down beneath the floor to the condensers. The throttle is controlled from three positions by means of hand wheels attached to a shaft, one at the floor and one at each platform. The valve gear is of the Rice & Sargent type, and has silent vacuum dash-pots. The main shaft is 22 ins. in diameter at the armature, The fly-wheel weighs about 85,000 lbs.



1500-HP GENERATING SET AT PORTLAND, MAINE

The valves and valve mechanism of these machines are of special interest. All the valves have double ports, and the exhaust valves are set nearer the piston than the steam valves, so that the clearance is largely reduced. They are operated by direct motion from the eccentrics without the medium of wrist-plates, there being two eccentrics, one for the inlet valves and one for the exhaust on each cylinder. The range of cut-off is from zero to three-quarter stroke, which gives the engine great capacity for overloads, and insures perfect regulation under any condition of load. Proper motion for the exhaust valve is secured by means of a toggle joint on each exhaust bonnet without the intervention of wrist-plates. A further advantage of this construction is that the moving parts have small mass, and are, therefore, fitted to operate quietly at comparatively high speeds. The cut-off latches operate without springs, dropping by their own weight, and are so constructed that the pressure from the eccentrics is on a line below the pivotal point, so that the latch cannot jump up. The wearing contact plates on the latches are square, and are made of hardened steel, so that by shifting a plate and turning it over, there are eight corners for wear. The point of cut-off is determined by a rod from the governor which actuates a yoke behind the latch, operating by means of roliers on a curved lever attached to the cut-off toe. The mechanism is so balanced that it requires very little power, and there is consequently little stress on the governor at the instant of cut-off. The entire design is so disposed that the utmost quietness in operation is secured, and, in fact, at a short distance from the engine, while in operation, it would be almost impossible to tell whether the parts were in motion or not. The intermediate rocker mechanism is supported by means of box-brackets and girders bolted to the engine frames. The governor is so designed that a centrifugal effect combined with an inertia effect is obtained. The governing wheel is about 3 ft. in

diameter, and is located, as shown in the illustration, on the first gallery. The governor is extremely sensitive and rapid in its operation, and the regulation of the engine, under varying loads, is very satisfactory. In connection with the governor is a safety device, designed to shut off the steam in case the governor belt should break or fail to work properly. The connecting rod is so designed that by removing one bolt it can be detached from the crank-pin, and being swung to one side, through an opening in the frame, the engine can, if necessary, be run by one cylinder only.

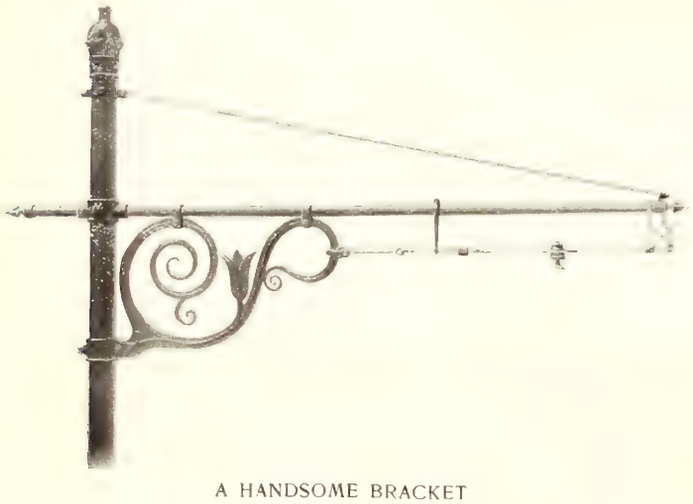
The fly-wheel weighs 95,000 lbs. and is built in eight sections, each section consisting of a piece of the rim and an arm. The rim joints are made by arrow-head, steel keepers, and the arms are bolted to an octagonal, box-section hub by means of pads which are perpendicular to the axes of the arms. The bolting is done by through bolts, which are reamed fit in their holes. The main bearing caps are adjusted by means of set screws, against which the ordinary cap bolts act, this construction giving a very accurate adjustment of the main bearings.

The parts are oiled by chains on the shaft, of which there are three on each bearing, leading the oil from large reservoirs in the pillow blocks. There are also four sight-feed oil cups on each bearing. On the crank side, the waste oil from the bearing is led out into the crank-pin, and on the other side there are channels which convey it back to the bearings. Drip pans are provided at each end under the crank disc, from which the oil is led to the filter.

The platforms about the machine are so arranged that any part can be reached and inspected without any danger to the attendant. The stairs are not spiral, but bend slightly and are not very steep, so that they are easily traversed, and the frame is very strong, the outlines, as seen from the illustration, being pleasing to the eye. The engine was built and installed by the Providence Engineering Works, of Providence, R. I.

An Ornamental Bracket

The handsome trolley bracket illustrated herewith is one of the many new designs made by the Creaghead Engineering Company, Cincinnati, Ohio, for export trade. The pole and arm are made of standard steel tubing, the smaller ornaments being made of malleable iron. As seen from the illustration, double insulation



A HANDSOME BRACKET

is used between the trolley wire and the arm of the bracket. The Creaghead Company has had great success with its ornamental brackets, its object having always been to combine strength with beauty.

A Novel Illuminated Fountain

The electric illuminated fountain, illustrated on this page, opens a new field of attractions for trolley parks and other summer resorts. The original idea of combining *tableaux vivants* with a display of brilliantly illuminated falling water is one that has already taken the fancy of the amusement-seeking public wherever it has been introduced.

The fountain shown in the engraving occupies a central position in Heine Park, Kansas City. It is strongly illuminated by electric lights, whose color can be changed at will. The figure, which, in a first glance at the picture, would be taken for a statue, is in reality flesh and blood. While the fountain is in operation, therefore, various poses, or even dances, can be introduced, and the beautiful effect of the graceful, handsomely attired performer, moving amidst a shower of brilliantly sparkling water, can be imagined.

ELECTRIC ILLUMINATED FOUNTAIN

This novelty is the invention of C. A. Dunlap, Providence, R. I., who is supplying it to parks and private individuals. Many of the designs are of quite a pretentious character, floor space being provided for the staging of an entire *corps du ballet*. The space in the center, which is occupied by the performers, is perfectly dry, and permits of a pyrotechnic display in conjunction with the aquatic features.

A Large Chemical Company

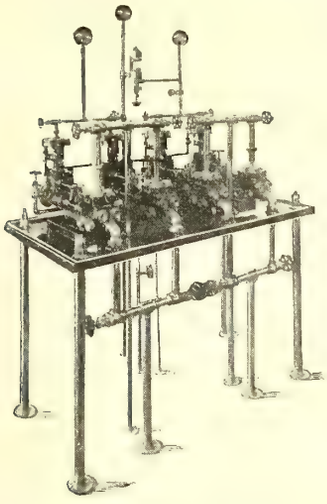
The Dearborn Drug & Chemical Works, Chicago, have recently increased their offices and laboratories. The latter are to-day among the most thoroughly and completely equipped for carrying on all kinds of testing and general analytical work to be found in the country. Coal, oil and water analysis, and any testing work pertaining to the steam plant, is done for the steam user. The laboratories are constantly open to the public.

The Dearborn Drug & Chemical Works have been in business some twelve years, and are to-day incorporated for $250,000. The numerous reports that they have made to the managers of power plants have made their name familiar in connection with engineering undertakings. The company has branch offices at St. Louis, Denver, San Francisco and St. Paul. The officers are: William H. Edgar, president; Robert F. Carr, vice-president and general manager, and Charles M. Eddy, secretary and treasurer.

This company is possibly best known to the mechanical world as a manufacturer of boiler feed water treatment. It analyzes the water and proportions to suit the requirements, preparations that remove scale from boilers, prevent new formation, and overcome the various deleterious actions that are produced in the boilers from feed waters. The methods pursued in manufacturing these boiler compounds are scientific, and appeal to the reason of the thinking buyer. Some five years ago the company went into the production of high-class lubricating oils, and is to-day furnishing many of the largest street railway and lighting power stations with some of the very best lubricants that can be produced.

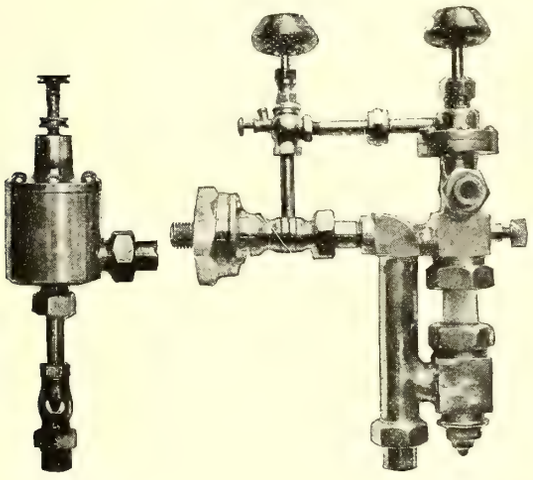
Automatic Lubrication

Probably no better illustration of the perfection of details in modern power-station work is afforded than by the state of refinement to which methods of lubrication have been brought. One of the best automatic oiling systems is, perhaps, the one furnished by the Siegrist Lubricator Company, of St. Louis, and illustrated in the accompanying cuts. This system is proving not only a great saving over hand lubrication, both in labor and oil, but the company claims for it greater safety and more positive action.



FOUR-PUMP TABLE

In the Siegrist system the oil is forced through the pipes by small steam pumps, the pumps being so constructed as to keep it at a constant pressure. The heart, so to speak, of the system is the oiling table, which contains the pumps. The usual form of table has four pumps, two for cylinder oil and two for engine oil. Ordinarily only one pump is kept running for one kind of oil, and the other is held as a reserve. They are direct-acting duplex pumps, and on the top of each steam-chest is a special governor for individual, automatic control There is a gage for both engine and cylinder oils, so that the engineer can see from a distance whether the proper pressure is being maintained. The steam for the pumps is supplied by a ¼-in. pipe in which is a steam gage. The piping on the table and the legs and pipes underneath

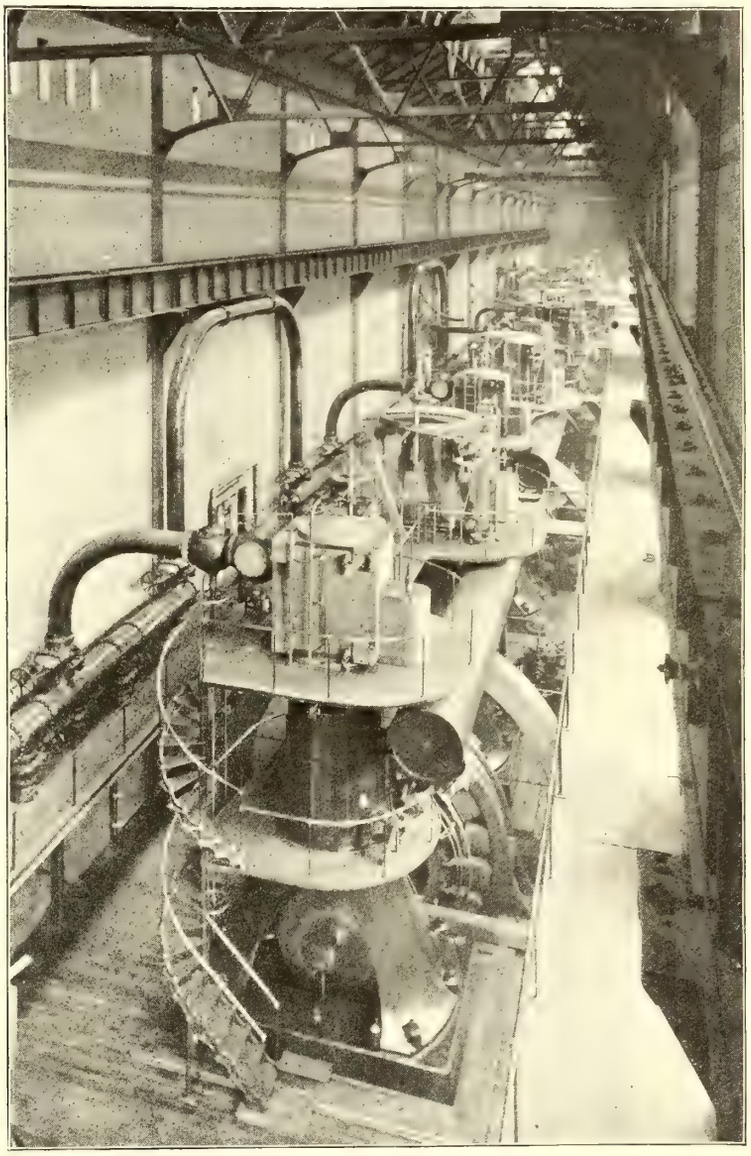


AUTOMATIC OIL CUP

CYLINDER LUBRICATOR

are all polished brass, giving a fine appearance to the installation. The table itself is made of polished and japanned iron with a raised edge to prevent oil, in case of accident, from running on the floor. The table just spoken of with four pumps is 65 ins. x 27 ins. and stands 3 ft. from the floor. The company also makes a table containing only three pumps, one for engine oil and one for cylinder oil and one to be used as a reserve on either engine or cylinder oil. A two-pump table is made for plants which run only a part of the time, and opportunity is afforded to pack pumps between runs.

In connection with these oiling tables the company makes a complete line of oil cups for use in connection with its oiling system. These oil cups are furnished with sight-feed and regulating valves, and provided with a flexible diaphragm, so that when the oil pressure falls below 30 lbs. per square inch the feed in the cup will be immediately shut off by the diaphragm. The object of this is to stop the flow as soon as the main valve supplying the engine with oil is shut off. All the engine oil on an engine is controlled by one valve and all the cylinder oil by another valve, so that it is not necessary to open and set or close cups or lubricators each time an engine is started or stopped. The usual



OILING SYSTEM IN METROPOLITAN WEST SIDE ELEVATED RAILWAY STATION, CHICAGO

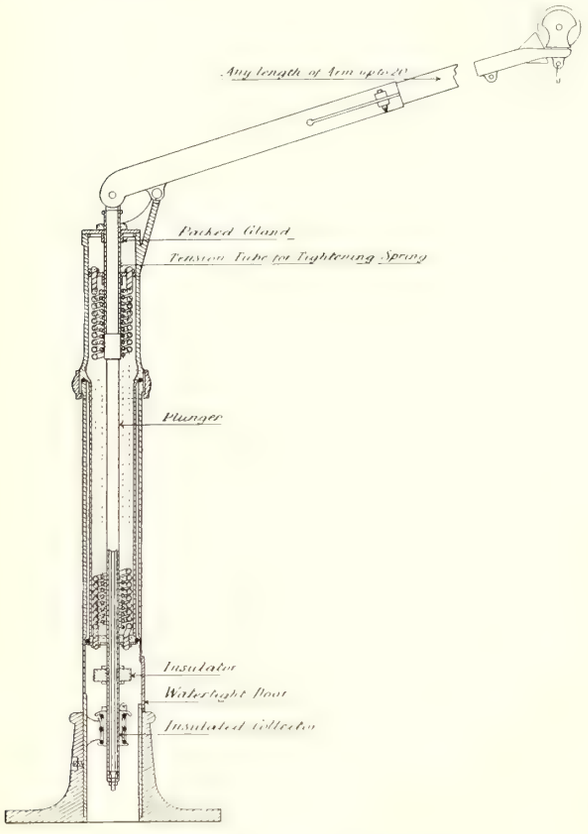
pressure kept on the oiling system is 80 lbs. per square inch, though, of course, any pressure can be used and it can be varied to allow for changes in temperature, or where a flood of oil is needed, as in the case of hot bearings. One of the advantages of this method of oiling is the ease with which any bearing can be flooded in case of trouble from heating. On the cylinder-oil pipes a pressure of 25 lbs. per square inch above the steam pressure is maintained. The cylinder lubricator is automatic, with 1-in. sight-feed, and has a flexible diaphragm so arranged that steam cannot back up into the oil pipes if the oil pressure falls below that of the steam pressure.

With the Siegrist automatic oiling system there is no handling of oil about the stations, save from barrel to tank. This means a large saving in both oil, labor and fire risk, to say nothing of the insurance against danger with hot bearings afforded by being able to use large quantities of oil and to get a flood on a bearing promptly. This is done without loss, as all oil not actually consumed is caught and returned automatically to filters, where it is refiltered, pumped to original tank and repumped over the machinery, thus making a perpetual circuit until it is actually consumed.

Those going to the Kansas City convention can see the Siegrist system in use at the power plants both of the Armour and Cudahy packing houses. It is also installed in the Metropolitan West Side Elevated Railway power house at Chicago.

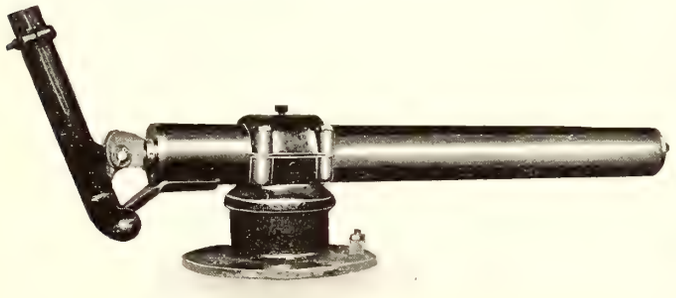
An Improved Trolley Standard

One of the latest types of trolley standards with inclosed springs is shown in the accompanying illustrations. The manufacturers are Lowdon Brothers & Company, but the apparatus is being placed on the market by Estler Brothers, of London, England.



SECTION OF TROLLEY STANDARD

These standards were, in the first instance, specially constructed to meet a special case presenting particularly severe requirements which existing types were unable to fulfil, and, as a result of their successful operation on this road, the manufacture has been taken up on a large scale. The standards have now been adopted by a number of railways, and have given great satisfaction. They are most substantially constructed, and, with the exception of the



STANDARD FOR SINGLE-DECK CARS

base, no cast iron whatever is used. To meet the necessities of all kinds of lines, three types are made, viz.: No. 1, the heavy pattern suitable for poles up to 20 ft. in length; No. 2, the medium pattern suitable for poles up to 16 ft. in length, and No. 3, the light pattern suitable for poles up to 14 ft. 6 in. in length. The construction of the three patterns is, in the main, identical, the difference being for the most part in the outside diameter and the weight generally, while the springs are, in each case, specially selected for the length of pole to be used.

The sectional illustration represents a No. 1, heavy pattern trolley standard for double-deck cars, suitable for poles up to 20 ft. in length, and from this the main features will be at once apparent. It consists of a heavy cast-iron base, which is bolted onto the roof of the car, and a steel tube forming the body of the apparatus fits into this base. In this tube again, and projecting above it, there is the spring container, resting on ball bearings in a ball race at the top of the tube, while it is kept in alignment by ball bearings at the lower end. The spring container is a malleable iron casting, and has plates at its upper and lower end to which the springs are bolted. The top end of the container is closed, and has a gland through which the center tube for the cable, and also the sleeve for adjusting the springs, passes. The trolley-pole holder is fixed to, and is pivoted on, the spring-container casting, and the trolley pole is firmly gripped by the holder as shown. The center tube passes through the container to an ebonite insulator, and is continued to the insulated collector by a brass tube, to the lower end of which the cable from the trolley wheel is fixed by means of a cone. The collecting device is an important feature of the standard, and it is very strongly made and well insulated. A three-arm web bracket is screwed into the body of the apparatus, and carries a porcelain petticoat insulator. Rubber rings are inserted between the casting and the insulator to protect the porcelain from jars and shocks. A split tube is fixed in the insulator having a cone connection at the top, while at the bottom it firmly grips the center brass tube to form a good connection. It is clear, therefore, that the cable connection from the trolley wheel is in no way subjected to a twisting strain, and consequently the trolley arm can be turned round and round any number of times without damaging the cable in the slightest.

The upward pressure of the trolley wheel on the wire is very easily adjusted, without opening up any part, by turning the sleeve mentioned above, which is screwed into the top plate of the container, finally pressing on a collar on the center tube. By this means the top plate is raised or lowered, putting more or less tension on the springs, the pressure on the wire being adjusted to a nicety. The springs used are covered by patents. They are double wound in a peculiar manner, that insures a uniform tension on the wire.

Great care has been taken to combine utility with neatness of appearance in this standard, and the electrical insulation has received special attention. Designs are made for both single and double-deck cars, the only practical difference being that those intended for single-deck cars are of a horizontal pattern, as shown.

A New Water Purifying System

Even a small accumulation of scale in boilers will greatly increase the fuel and repair bills of a power station, reduce the capacity and efficiency of the plant and cause the burning out of boiler tubes. In many districts this scale proves so troublesome that it is difficult to keep a plant in operation without frequent interruptions for the purpose of cleansing and repairing the boilers and replacing the tubes. The system about to be described is claimed to remove from the feed-water all scale forming and other foreign ingredients. It is called the Tweeddale system, and is based upon the principle that all foreign substances, whether held in solution or suspension, can be released by electrical and chemical action and precipitated to the bottom of the tank.

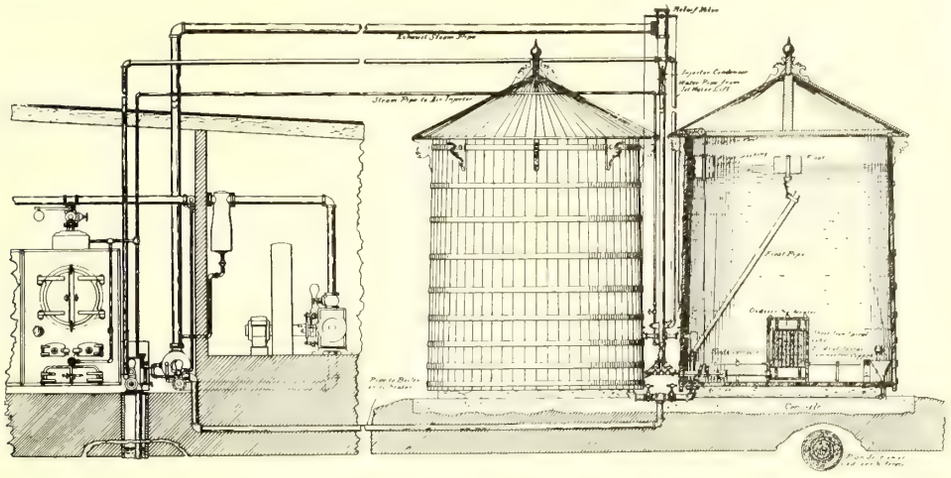
The apparatus itself consists of a pair of tanks which hold water supply sufficient for six hours' run. In the bottom of each tank is located an aerater and oxidizer combined. This device contains a system of metallic plates filled in with coke, which set up a chemical and galvanic action in the water, separating its ingredients and forcing it to release its hold upon all foreign matter. A strong jet of air is also forced through the oxidizer and aerater pipes, producing an agitation and aeration, which, combined with the electrical action and chemical reagents, cause first a thorough mixture of all the contents of the tank, and then a releasing of the impurities held by the water. At the proper time a small quantity of reagent is injected, and when the disturbance ceases a coagulated mixture is formed which seizes upon the released impurities and carries them down to the bottom of the tank by ordinary precipitation at the rate of about 12 ft. per hour.

No mechanical filter is required, the only filter employed being that which forms in the water itself and carries the released impurities to the bottom of the tank by ordinary sedimentation.

At the end of the process water which was cloudy and muddy

before becomes clear, and not only is it clarified, but it is purified and softened.

The purified water is drawn from the surface by a pipe suspended from a float so as to have its opening always a little below the surface, while the percipitated impurities are carried away by waste pipes located at the bottom of the tank. While one tank

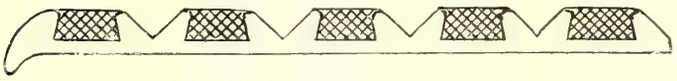


ELEVATION OF WATER PURIFYING PLANT

is being treated as described above the water supply is taken from the companion tank. The whole process is simple, effective and economical, and the apparatus and reagents employed are quickly understood and easily handled by the ordinary engineer. Water treated by the system will not only leave the boilers in good condition, but can be used to advantage in laundries, breweries, etc., where a clear, soft water is desirable. Purifying plants which work upon the above principle are being installed by the Chicago Boiler Cleaner Company, of Chicago.

A Safe Car Step.

The advantage of a car step upon which it is impossible to slip is apparent to all, and especially to managers who have to meet frequent suits for damages from this cause. The Mason Safety Tread, illustrated herewith, is claimed to be a sure safeguard



SAFETY TREAD FOR CAR STEPS

against slipping, and has been in successful operation on many roads. Added to the immunity from slipping the safety treads take all the wear, and as the lead, which constitutes the non-slipping surface, is protected by a steel back and ribs, the treads will last for many years. Moisture, frost or light snow is said to have no effect on their safety-securing properties.

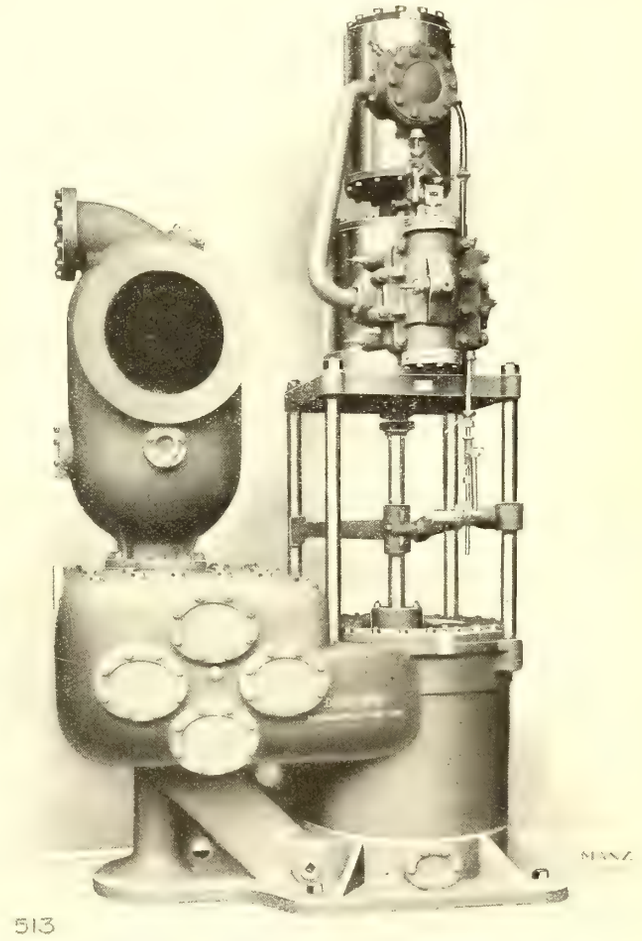
The safety tread can be used upon stairs, like those of the elevated stations in New York, Chicago and Boston, public buildings, railroad stations, school houses, etc., and upon ship ladders in the navy, but during the past two years a large demand, which is constantly increasing, has been developed from the street railway companies. The American Mason Safety Tread Company, of Boston, manufactures these treads, and has agencies in all the larger cities

Vertical Air Pump and Condenser with Compound Steam Cylinder

The condensing apparatus shown in the accompanying illustration is designed for the engines of street railway plants and other places where economy of fuel or increase of power is desired. It is manufactured by the Dean Brothers' Steam Pump Works, Indianapolis, Ind., and combines several special advantages with the general features of this company's output.

The vertical type of air pump is said to be much more durable than the horizontal type, because there is so little side wear in the cylinder and stuffing boxes. In horizontal pumps especially large sizes, there is a constant downward wear of piston and rods, due to their weight. Any sediment in the water will settle on the lower side of cylinder, where this pressure is greatest, causing the piston and cylinder to wear rapidly. The vertical air pump occupies but little floor space, and it is much more convenient to set down into a pit, should it be necessary to lower the air pump in order to reduce the vertical lift of injection water. The steam cylinders are steeple compound with the high-pressure cylinder on top. The high-pressure steam chest is circular and contains a plain slide valve that is operated from the chest piston on the low-pressure cylinder.

The apparatus has Dean Brothers' noiseless valve gear, the valve-actuating mechanism being on the low-pressure cylinder. The auxiliary slide valve has extra long travel, and the stroke of pump may be lengthened or shortened, even while running, by moving a stud in a segmental slot. The piston rod between the high- and low-pressure cylinders is fitted with automatically adjusting metal packing that will always keep tight. The low-pressure cylinder is fitted with valves for regulating the steam passing to each end of cylinder. The air pump being double acting, the same amount of work is done in the down stroke as in the up stroke. The lower head of low-pressure cylinder is removable, so that the cylinder and packing may be inspected at any time. The piston rods are separable at the cross-heads, the



VERTICAL AIR PUMP AND CONDENSER

cross-head being of steel, and the rods fitted in on a taper and held by flat keys.

The air-pump cylinder head may be taken entirely out of the way by unkeying the piston rod. The stuffing box and all valves are water sealed, there being no valves in the air piston.

The dimensions of the apparatus shown are as follows: 14-in.

high-pressure steam cylinder, 20-in. low-pressure steam cylinder, 38-in. air cylinder, 18-in. stroke.

For electric traction or electric light plants this apparatus is claimed to be especially adapted, as it can be operated on ½ per cent of the steam used by the engine, and will save from 20 per cent to 30 per cent of the total steam consumed by the engine.

Long Life of an Underfeed Stoker

The Jones underfeed stoker, in its present form, has been on the market since 1895, and the merits of the device have been well tried and tested. An extended technical description of the stoker is not, perhaps, necessary here, but it will be of considerable interest, however, to note some of the practical results that have been attained in the way of lasting qualities and economy of fuel as well as smokelessness. In the Jones underfeed stoker the coal is burned over a long retort. The coal is fed in from beneath by a ram with a reciprocating movement, and is gradually forced up over the edges of the retort. Around the edges of the retort are a row of tuyere blocks through which an artificial blast of air is forced. The combustion of the fuel, which takes place over its surface above the retort, is supported by the blast of air coming through these tuyeres at a low pressure. The tuyere blocks are made of heavy cast iron. The only moving part about the furnace is the ram which supplies the "underfeed" of coal, and which, being down in the cold fuel, will manifestly last a long time. The tuyere blocks are nearer to the hot fire, and it might at first thought be expected that they would be burned out rapidly, although on further consideration it is evident that since the air blast is constantly going through them they are kept comparatively cool. Practical demonstration is more convincing than theory, however, and the accompanying engraving from a photograph of one of the La Grange, Ill., Light & Water Company's furnaces is a striking proof of the way it stands up under use. It shows the condition of the furnace after an eleven months' run, day and night, without repairs, and is certified to by C. T. Moffitt, secretary and treasurer of the company.

FURNACE AFTER ELEVEN MONTHS' SERVICE

An interesting illustration of the way this stoker burns the gases producing smoke was furnished by the Northwestern Straw Works at Milwaukee, where it was necessary, formerly, to burn hard coal because the practice was to bleach straw on the roof and soot was not desirable. The Jones underfeed stoker was put in, and not only was the plant able to burn low-grade bituminous screenings without smoke, but the steaming capacity of the boilers was greatly increased. This is, however, the natural result with a stoker of this type, as the coal comes up from underneath and the volatile matter which makes smoke and which is given off when first the coal is heated up must pass through the bed of hot coked coal on top before it can go up the flues.

The Underfeed Stoker Company of America has been organized within the past year, and has a strong financial backing. Fred A. Daley, who has been connected with the manufacture of the stoker ever since its invention, is manager of the company. The Toronto Railway Company has this stoker under eight 160-hp boilers.

A Traveling Link Grate

The traveling link grates made by the Green Engineering Company, of Chicago, have met with remarkable success in the short time they have been on the market. It is now only about three years since the company started making these grates, and in that time many of the best contracts in the field have been secured, and numerous second orders received. Among the most important installations may be mentioned two orders from the Milwaukee Electric Railway & Light Company aggregating 11,000 hp, two orders from the Chicago Union Traction Company amounting to 8000 hp, and two orders from the St. Louis Transit Company amounting to 13,000 hp. The Metropolitan Street Railway, of Kansas City, has 3000-hp capacity in these grates at its Riverside station. Two of these grates at Kansas City were put under two 500-hp boilers two years ago, and at the time were notable as being the widest moving grates ever built, being 10 ft. 2 ins. wide. The Armour packing plant in the same city has since put in some grates 11 ft. wide. The construction of the Green traveling link grate is such that there is practically no limit to the size of the grates that can be built, the limit being the size of the boiler. By means of a peculiar form of clip the grates can be repaired without withdrawing the connecting rods which hold the sections together. The clips are of five different designs, and any one can be removed without disturbing the rest of the grate. Their form is such as to allow plenty of air for good combustion, and the result is an almost perfect combustion with exceedingly little smoke. This claim of the makers is fully demonstrated by the operation of the plants equipped with the grate. A serious drawback to automatic stoking when first introduced was that the repairs on the apparatus and the expense of throwing the stokers out of service for repairs almost amounted to more than the resultant saving in firemens' wages. Since then marked improvements in the lasting qualities of automatic stoker grates have been made, and in the present instance the repairs are comparatively quickly and easily made, making an important step in advance. As an illustration of the saving in labor effected by the use of Green chain grate mechanical stokers, the case of the Cincinnati Edison Company, where there are six 750-hp boilers and the boiler-room force is only four men in twenty-four hours, may be cited.

The Green Engineering Company now devotes its entire time to making and selling grates. The main offices are in Chicago and the officers are: W. M. Green, president; John R. Gent, vice-president; P. Albert Poppenhusen, treasurer; Herman A. Poppenhusen, secretary, all of whom, through previous experience, are familiar with steam engineering work.

A Powerful Snow Plow

A description was published last month of the new snow plow brought out this season by the Taunton Locomotive Manufacturing Company, but the illustration given was of a plow built by the company for very heavy service. The accompanying engraving shows a correct view of the plow described last month. For convenience of reference some particulars of this plow are republished from the last monthly issue.

The plow weighs 5 tons without motors, and is thus somewhat lighter than the Taunton standard plow of last year. This reduction in weight has been secured entirely by dispensing with cast iron, especially in the shape of the two heavy counterbalance weights. The manufacturers have also substituted wrought iron and timbering for a large amount of cast iron used in last year's plow, and the noses are now raised and lowered by a chain, operated by worm and gear mechanism. The whole weight of the nose rests on the rail, although the height of the nose can be adjusted to suit any condition. This renders the plow especially valuable in light snows, and guarantees a clean rail under these circumstances. At the same time the shape of the nose and heavy oaken backing give sufficient strength for heavy drift work.

The wings are also a departure from former Taunton practice, and are believed to be an improvement, inasmuch as they dispense with the wing hinge pin, always difficult to keep in shape when the plow is sent against frozen ground or hummocks of ice. The nose is carried so far back on each side that the wheels are thoroughly protected, and the sides of the plow are also protected from snow without in the least interfering with accessibility to the running gear. The hood or overhang part of the roof has been practically taken away to make perfectly easy the manipulation of the trolley rope. The effective Taunton digger is applied to this plow, and, as now built, the manufacturers, who have had many years of experience in electric plow building, state that they can see no opportunity for further improvement in a plow for all-round single track work. The changes made this year, as stated, are not in design, but are mainly in the substitution of timber and wrought iron in place of cast iron. For ordinary work the excessive weight is not often necessary.

A Tripartite Steel Pole

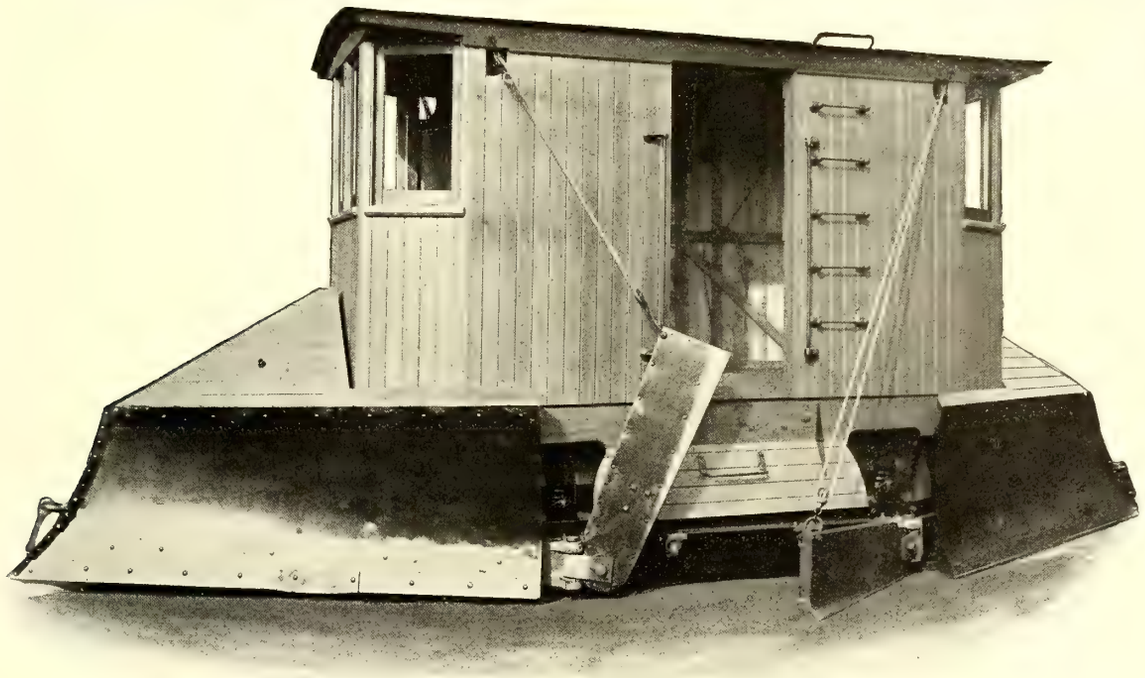
The steel pole illustrated herewith has recently been placed on the market by the Electric Tripartite Steel Pole Company, of New York, and is designed especially for trolley-wire service, though similar poles are also manufactured for electric light and power lines and telegraph and telephone wires. It consists essentially of three high-carbon rolled-steel T's or U's, formed in a tripod shape, and set in a cast-iron base in which they are keyed. At the head is a cap in which each of the three members is riveted, and between the cap and base are cast-iron spreaders, making a positively rigid pole.

Several advantages are claimed for this kind of pole. One is, that as the base is broad and contains a great proportion of the weight, the excavation required for setting is not as deep as that needed with a tubular pole. In fact it is stated that ample rigidity for this pole in railway work is secured by setting it 3 ft. deep in concrete. Again, the pole can be shipped and distributed unassembled, and can be put together at the point of use.

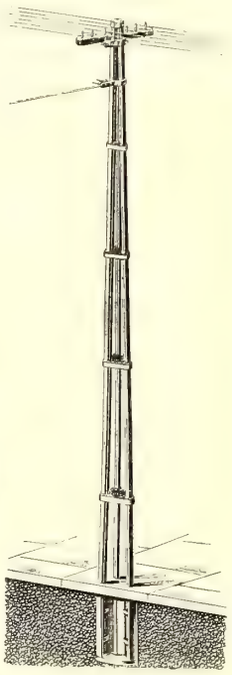
The tripartite poles were tested at Stevens' Institute, Hoboken, N. J., September, 1899, with following results as an average of twelve tests:

300-lb. strain, double reading.....1.73-in. declivity
400-lb. strain, double reading.....2.37-in. declivity
500-lb. strain, double reading.....3.00-in. declivity

In every instance when the load was released the pole came back to its original position. The weight of the poles is from 350 lbs. to 700 lbs.



A POWERFUL SNOW PLOW

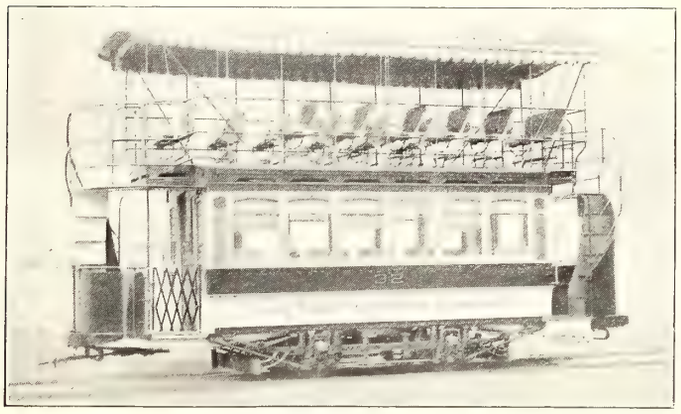


TRIPARTITE POLE

New Cars for Cape Town Tramways

The handsome car shown in the cut on the next page is one of a lot which the Cape Town Tramways have purchased from the J. G. Brill Company, and which has just been shipped. The details of construction embody the latest improvements in cars of double-deck type. The bodies are 17 ft. long with 5-ft. platforms making the car 27 ft. over the dashers. The width at the sills is 6 ft. 10 ins., and at the posts a fraction over 7 ft. 4 ins. Stairways leading to the upper deck are of the Brill pattern, which in connection with the hood protect the motorman, while they discharge the passengers on the lower deck directly at the entrance. There are twelve reversible back seats on the upper deck and the same number of spring cane seats and backs in the body. The lower seats are reversible excepting those in the corners, which have stationary backs.

One valuable feature in construction of the canopy is found in the fact that it is braced in all directions, thus giving a much greater stiffness and durability to this part of car which is always subjected to severe strains. The truck is the Brill No. 21-E, with the usual double journal springs and half elliptic on the extreme ends. The trim inside is of white ash with three-ply veneer head linings. The Brill practice of using a very high railing around the upper deck is followed in this case, thus insuring the safety of the passenger when alighting even though the car be in motion.



DOUBLE-DECKED CAR FOR CAPE TOWN

The height of the car inside is 6 ft. 8 ins., ample for men of rather more than the average height. There are two oil headlights, radial draw-bars, angle iron buffers, a pair of Brill sand-boxes and two "Dedenda" gongs. The upper deck is defended by heavy curtains at both sides and ends.

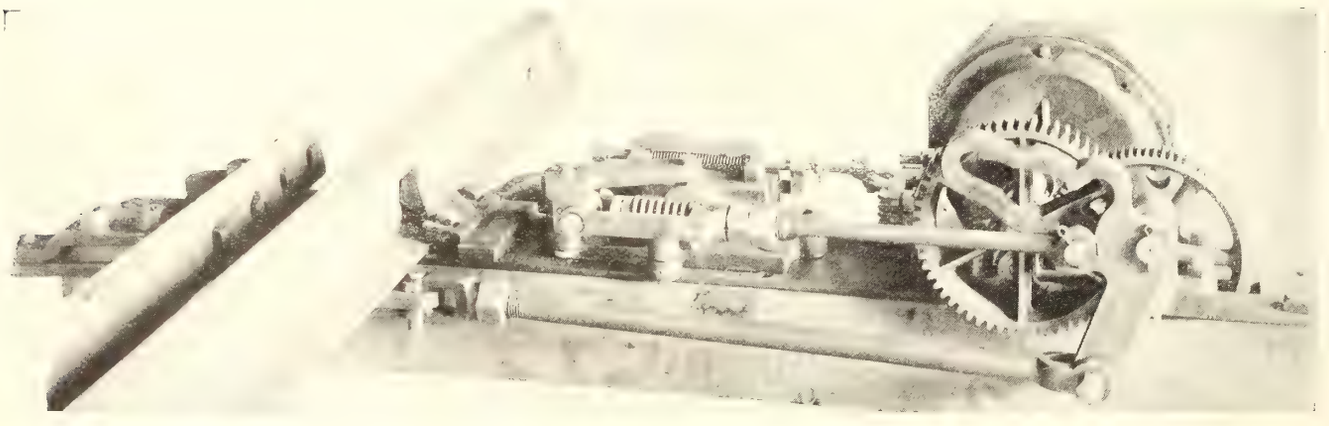
In connection with this order a pair of cars 22 ft. in length, of the same general type were also purchased. The principal difference is that they are mounted upon a pair of "Eureka" maximum traction trucks fitted each with a G. E. 1000 motor. The larger cars are capable of making a much higher rate of speed, and will be valuable in the city and suburban service.

An Interlocking System Applied to Grade Crossings

The interlocking apparatus of the Taylor Signal Company, which is finding favor with steam railroad men for large interlocking plants in switchyards and station terminals is also being applied to the protection of grade crossings of steam and electric roads. Two such applications have been made on the main line of the Lake Shore & Michigan Southern at Fremont, and at Genoa, Ohio, where the Toledo, Fremont & Norwalk Electric Railway crosses it. Before describing this crossing in particular it will be well to explain some of the details of the Taylor Signal Company's apparatus. The equipment uses electricity entirely for the working of both switches and signals instead of compressed air or mechanical connection to the tower by rods and wires. To operate the switches and derailing switches a 1-hp electric motor is employed. One of these motors, with accompanying mechanism, connected to a derailing switch, as used on the interlocking grade crossing is shown in the illustration. The mechanism operates as follows: When the motor starts to open the switch the first part of the movement pulls a pin that unlocks the switch. The next part of the movement opens the switch itself, after which the locking mechanism is again thrown in. The motor is automatically stopped at the end of the cycle of operations by the throwing of a quick break switch, which reverses the armature connections, shuts off current supply and connects the motor to act as a dynamo. Three purposes are accomplished in this operation. The motor connections are reversed so that the motor is ready to close the track switch again upon the closing of the supply circuit; the dynamo action of the motor helps to stop it; and the locking is released so that the signals can be set at "clear." Furthermore the current obtained from the motor when acting as a dynamo is used to energize indication coils in the interlocking machine, which show that the switch has been completely thrown, and permit the lever to complete the balance of its stroke. Until this takes place the signals cannot be set.

To work the semaphore signals on both the steam and electric roads a 1-6-hp motor is used. This motor is placed upon a platform attached to the semaphore pole, and by means of a set of double reduction gears pulls the signal to a horizontal position against the force of gravity. When the motor has pulled the semaphore to position a switch automatically throws in series with the motor a pair of magnet coils, acting against a disc on the armature shaft. The disc is held by the magnets, so that it cannot revolve, and the signal is held set as long as current is maintained in the clutch magnets. The current for working the switch and signal motors is obtained from a 60-volt storage battery, which is charged at intervals by a gasoline engine and dynamo. The current at 60 volts required to throw a switch in two seconds is about 7 amps. To set a semaphore signal in two and one-half seconds 2 amps. is taken.

The crossing at Fremont, Ohio, which is protected by this apparatus, is provided with a derailing switch on the electric road at the crossing approach, and a low semaphore signal indicating its position, and two semaphore signals (home and distant) on the steam road approach to the crossing. There is also an outlying derail on the electric road, which a car encounters after leaving the crossing, the object of which will be explained later. The home signals on the steam road are 600 ft. from the crossing, and the distant signals 1800 ft. These signals stand normally at safety. When a train gets within 2300 ft. of a crossing it enters a track circuit section, which locks out any attempt to change the signals and let an electric car on the crossing when a steam train is within 2300 ft. When an electric car approaches the crossing the steam road signals are set at danger, the derail on the electric road is closed, and its signals set at clear. At the same time the derail in the electric track on the far side of the crossing is opened. After an electric car has gone over the crossing it cannot proceed until the steam road signals have all been cleared and the electric road approach put back at danger. This is to prevent the steam road signals being left so as to block the road. These signals are designed to be operated either by a towerman or by the conductor of



SWITCH-OPERATING MOTOR AND MECHANISM

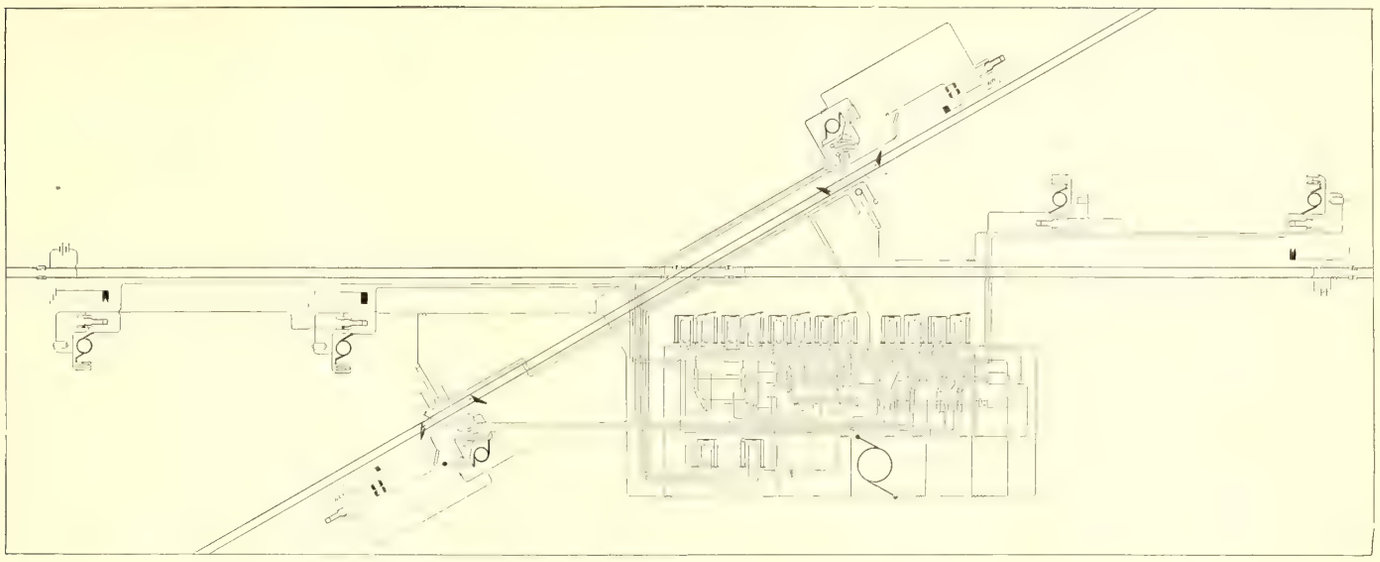
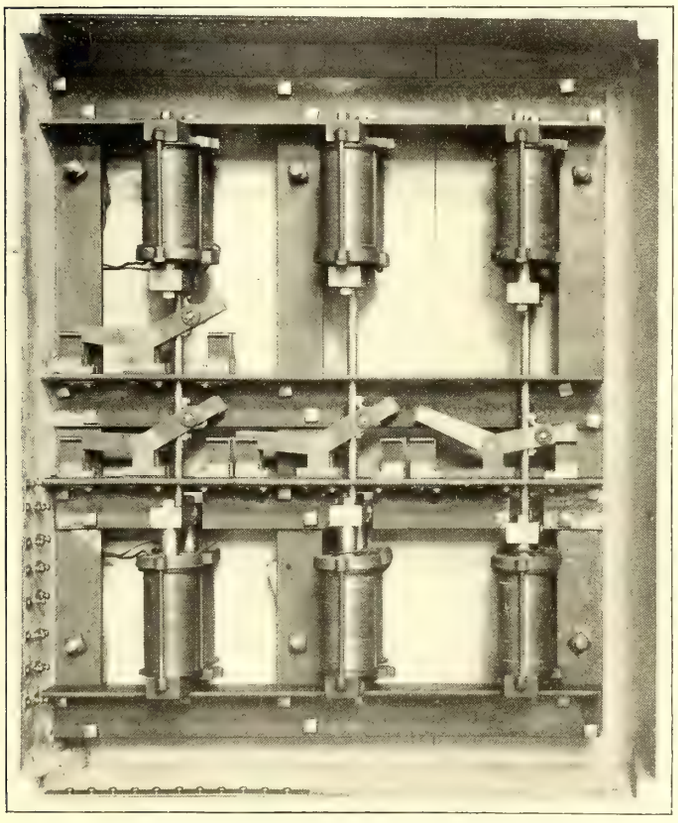


DIAGRAM OF SIGNAL AND INTERLOCKING SYSTEM

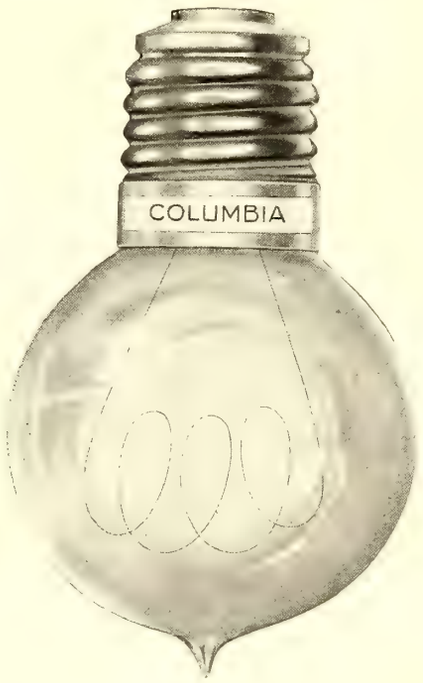
the electric car from a locked box near the track. The signals being entirely automatic and interlocking this can safely be done. When the towerman is absent the interlocking machine is worked by solenoids, the solenoid circuits being controlled by a small switch in the conductor's switchbox beside the track. The same switchbox is used for both approaching and leaving cars, the switch being thrown in one direction for a car going one way and in the other direction for a car going the other way. The conductor has simply to hold the switch closed for a short period, a spring holding the switch normally in a central position. The possibility of doing away with a regular towerman at the crossing is one that recommends it strongly to street and interurban roads, and the interlocking feature makes it absolutely safe. The factory of the Taylor Signal Company is at Buffalo, and headquarters are also maintained at Monadnock Block, Chicago.



SOLENOIDS FOR INTERLOCKING SYSTEMS

Incandescent Lamp for Railway Use

The Columbia Incandescent Lamp Company, St. Louis, Mo., is now entering on its tenth year. During this time the firm has been in continuous operation, and can, therefore, well claim to be one of the oldest lamp houses in the country. By the inauguration of such methods and changes from time to time as to keep abreast of the business and by the use of the latest and most improved machinery, the company has striven to give satisfaction to its customers. As a result of this in the railway field it now holds several yearly contracts with roads throughout the country for supplying their cars with lamps. One style of these successful lamps is illustrated in the accompanying engraving. The filament of the lamp is carefully made at the company's own factory, and its brilliancy is practically maintained throughout its long life. As seen from the cut, the filament is made heavy enough to withstand the shocks of railway service without anchoring.



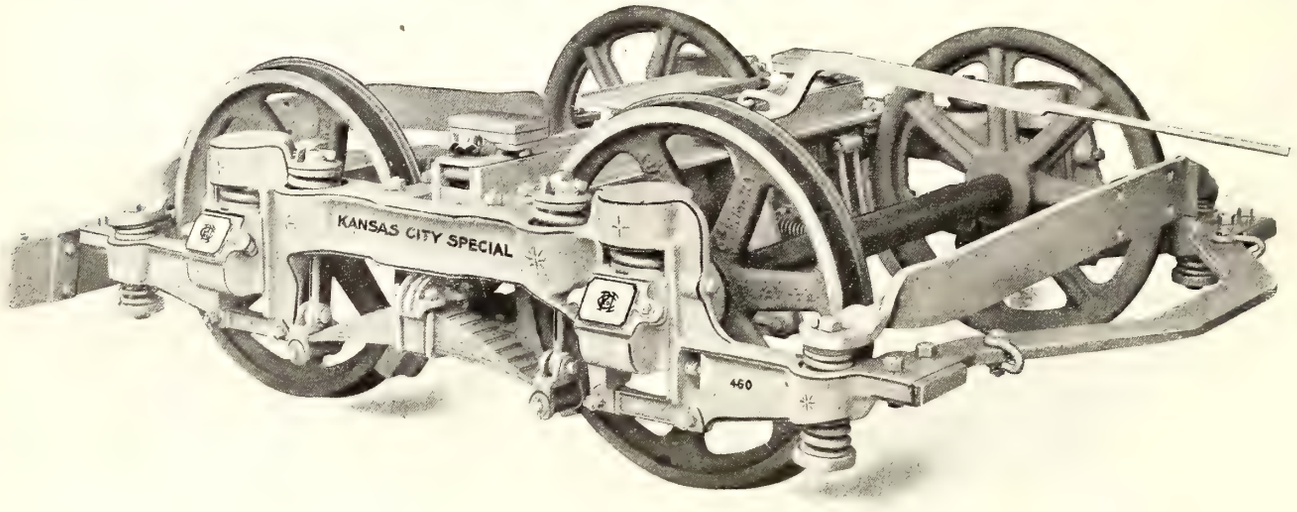
RAILWAY LAMP

Another form of lamp which has given great satisfaction wherever introduced is made with the standard size of bulb. The spiral form of filament is used in this lamp, and it is found to be strong enough to work admirably without anchoring.

The "Kansas City Special" Short Wheel Base Truck

The accompanying engraving shows the "Kansas City Special" short wheel base truck, manufactured by the Peckham Truck Company. This truck has proved very popular in Kansas City, as is shown by the fact that the Peckham Company has already furnished the Metropolitan Street Railway Company, of that city, with 102 pairs of these trucks, and has orders for 148 pairs in addition.

This truck is constructed on the same general lines as the Peckham regular 14 B-3 short wheel base truck, the difference being in the construction of the cast-steel side frames, which are modified to suit the requirements of the master mechanic of the Metropolitan Street Railway Company, of Kansas City. The changes made are mainly in the construction of the end extensions for supporting the motors, which in this truck are made lower, and are provided with pockets for the motor suspension springs. These are located nearer the axle than in the regular 14 B-3 construction, so that the weight of the motors is carried nearer the axles.



"KANSAS CITY SPECIAL" TRUCK

The end cross-bars connecting the two side frames are made flat in this construction, while in the 14 B-3 trucks they are of angle bar construction.

The bolster of this truck, as in the 14 B-3, is a center bearing swing bolster, carried upon two half elliptical springs, which, in turn, are carried by coil equalizer springs. Large coil springs are also placed over the journal boxes, thus making three separate sets of springs between the car body and rail, insuring a very easy and steady riding car under all conditions of load.

In this truck, as in the regular 14 B-3, the motors are placed outside of the axles, and the brakes are constructed with inside brake shoes.

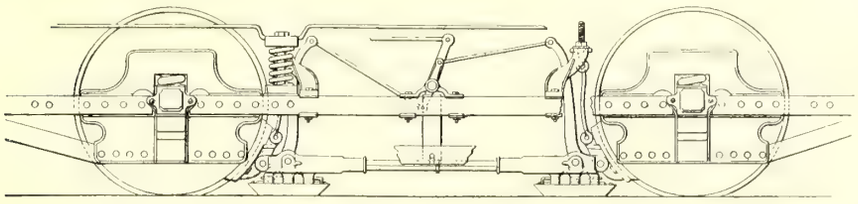
Combined Track and Wheel Brake

The accompanying engravings illustrate a new track and wheel brake which has been lately put upon the market. The brake presents several novel features, and has been giving satisfactory service upon some of the cars of the Union Traction Company, Philadelphia, where it has been installed. The inventor of the device, Charles V. Rote, claims that it is exceedingly efficient and easy of application. Its simplicity adds to its safety, and the ingenious mechanical arrangement facilitates the making of quick stops with very little inconvenience to the passengers. The principle upon which the Rote brake operates is quite simple, and there is nothing in the mechanism which can easily get out of adjustment. There is a flat shoe about 1 ft. long suspended over the rail. This is so adjusted as to barely clear the rail, with which it can be brought into contact by a slight turn of the brake handle. An ingenious mechanical device, somewhat analogous in principle to the cantilever, allows the brake to be applied with great power. It is so made that the grip and release of the brake are rendered elastic, thus obviating the unpleasant jolt occasioned by the sudden application of a wheel brake.

TRACK AND WHEEL BRAKE ON MAXIMUM TRACTION TRUCKS

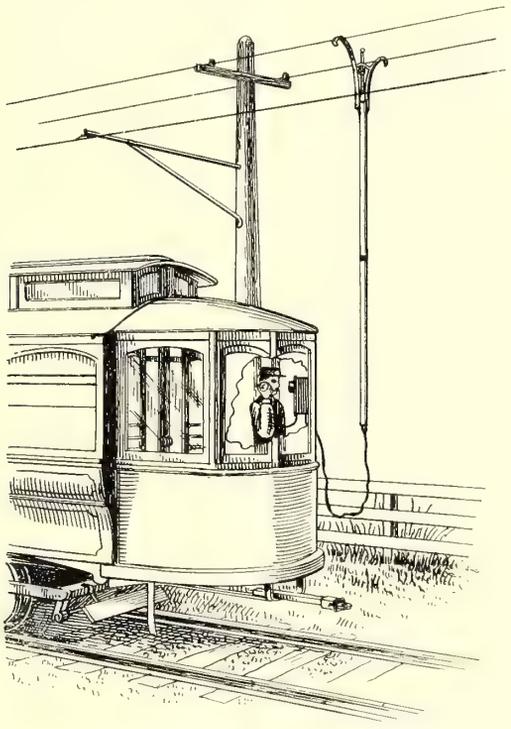
On an eight-wheel car it is evident that the shoe surface is sufficient to cover a large length of rail, thus giving great power for stopping the movement of the car. The pressure of the wheels

on the track at the same time is largely diminished, so that should they by any chance become locked, the sliding would not be disastrous to their tread. The shape of the shoe is such that it will pass easily over uneven joints in rails and cross-frogs, and provision is made for adjusting to wear. It is, however, close enough



DETAILS OF TRACK BRAKE

to the track to keep it clear of ice or snow, any coating of ice that the front wheels may crush being removed by the shoe following. The mechanism can be worked from either end of the car by an ordinary hand-brake spindle or by air, but the amount of pressure required is so slight that the hand-brake gives sufficient power in all cases. One of the illustrations shows the brake as applied to a maximum traction truck; in this case but one shoe is used between each pair of wheels. In the ordinary bogie truck, where both wheels have a separate brake shoe, two track shoes are also used, as shown by the detail drawing.



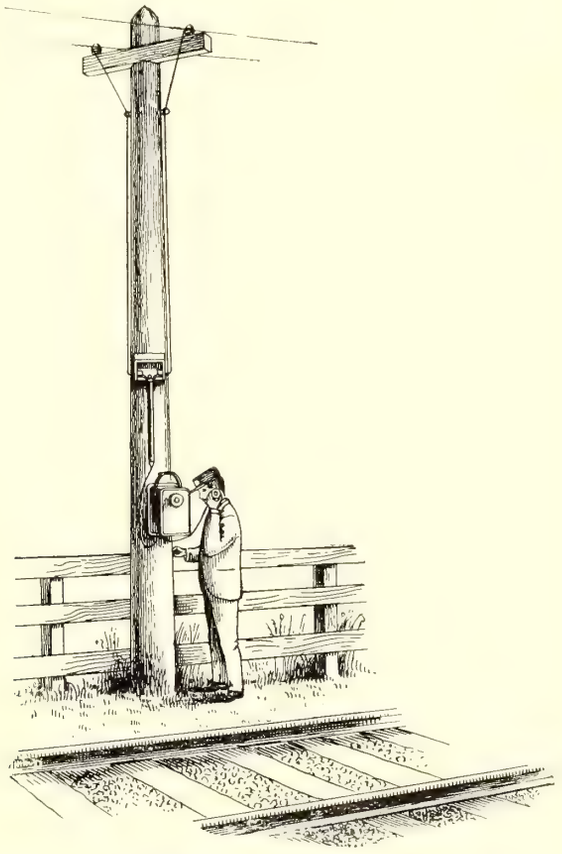
TELEPHONE IN USE ON CAR

The brake is being manufactured by the Rote Track Brake Company, Lancaster, Pa.

A Portable Telephone for Trolley Cars

The accompanying cuts illustrate a device by means of which the conductor of a car is at all times able to communicate with the office or power station. The system comprises many ingenious features, as every precaution has been taken to make it thoroughly reliable, and its extreme simplicity, both of construction and operation, will do much toward recommending it to the managers of street railways in general, but especially of those roads which traverse long stretches of open country.

The mode of application is well shown in the engravings. A jointed pole, through the center of which passes the double telephone cord, is provided at one end with wide-spreading hooks, and at the other end with short-contact pins. The hooks are electrically connected to their respective contact pins by means of the enclosed cord, and cylindrical terminals on the end of the flexible cord connecting with the car make the circuit complete between the telephone and the overhead telephone wires. Each telephone is furnished with a holder, which is placed in the car in any convenient place. This holder is stationary, but the telephone can be removed from the car, as shown in the second illustration, where the line is too far from the track to be reached by the connecting cord, or where, for any reason, this method is thought preferable, as, for example, in a crowded street. The field box shown in this cut has a sloping roof protecting the terminals of the telephone circuit, which receive the hooks on the portable pole, and, being much nearer the ground, does not require the use of such a long pole. It is evident that with the telephone remaining in the car connection could be made to the field box in the same manner as to be the overhead wires themselves. This is of service where the wires are suspended at a distance above the track too great for the length of the pole, although the much simpler expedient of dropping wire hooks down from the line to the required level is adopted where



TELEPHONE TRANSFERRED TO POLE

many of these cases occur. Cleats are provided on the portable pole on which the flexible cord is wound when not in use.

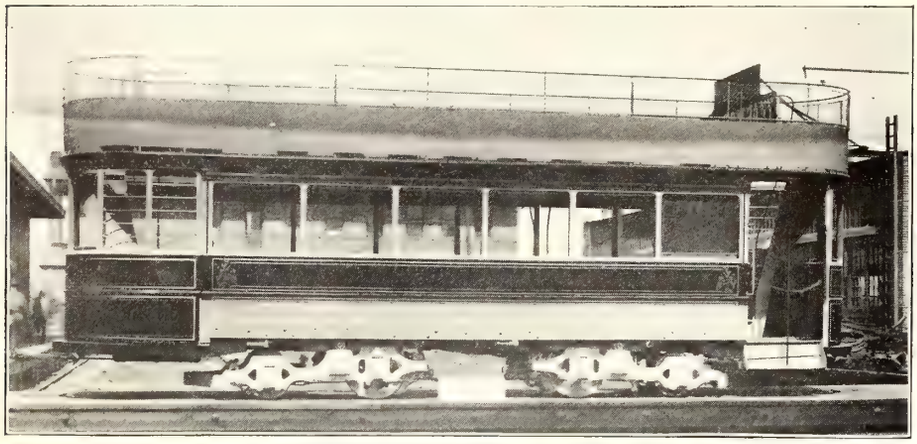
After the connection is made the telephone is used in the ordinary manner. Its application to this service, as described above, is due to M. Garl, who has secured patents on the novel features employed. The system is being put on the market by the Garl Electric Company, Akron, Ohio.

New Power Station at Portsmouth, England

The Corporation of Portsmouth has just awarded the contract for the complete equipment of the power station to Dick, Kerr & Company, which already has orders for supplying eighty motor cars. The initial installation will consist of about 2000-hp capacity, and engines of slow-speed Corliss type will be used, direct coupled to generators supplied by the English Electric Manufacturing Company.

Cars for the Isle of Thanet

The first illustration herewith shows a 21-ft. double-deck box car built for the Isle of Thanet Railways Company, Ltd., by the St. Louis Car Company. This car is mounted on two St. Louis Car Company's No. 13 trucks. The total length of the car body is 32 ft. 4 ins. over all; the clear height inside of the center is 6 ft. 4½ ins.; the width of the car is 6 ft. 6 ins. and the length of each platform is 5 ft. 3 ins. The interior of the car is finished in quartered sawed oak, with longitudinal seats upholstered, and the second story is equipped with garden "walk-over" seats. All trimmings are of bronze. The cars were built complete and then taken apart, boxed and shipped.



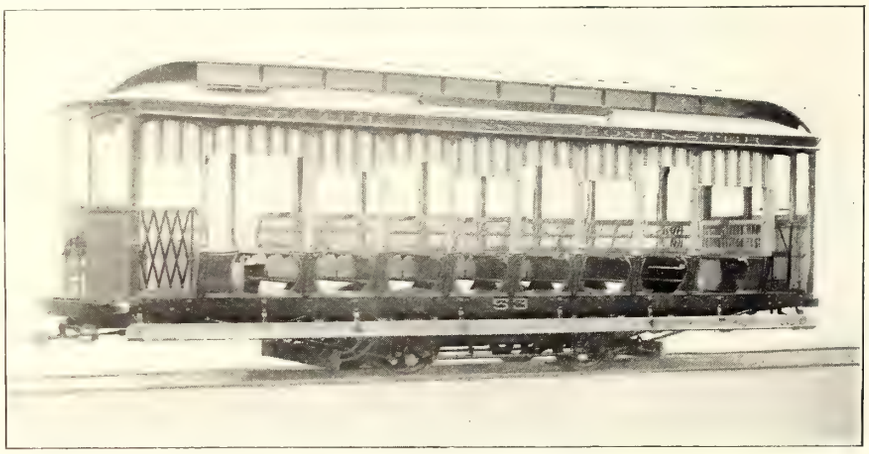
DOUBLE-TRUCK CAR FOR ISLE OF THANET

The second illustration shows a 17-ft. car mounted on a St. Louis Car Company's No. 8 single truck. This car is 28 ft. 4 ins. over all, 6 ft. 6 ins. wide, and the platform is the same length as the long car. The car is similar in every respect to the car mounted on double trucks, shown here.

Open Vestibuled Car

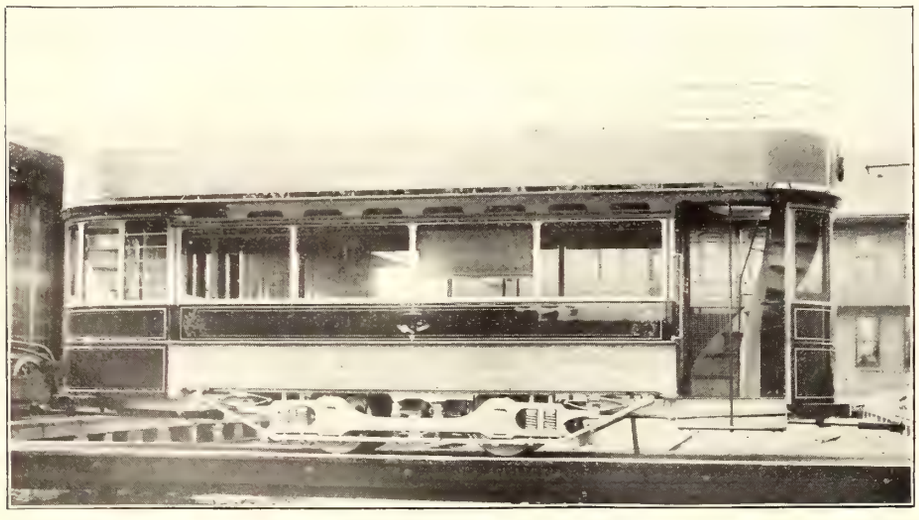
The Fitchburg & Leominister Street Railway has just received from the J. G. Brill Company a number of open cars of a novel design. One of these cars which was shipped to road last week is shown in the illustration given herewith. It is 31 ft. long over the bumpers, has a 3-ft. platform, and is 6 ft. 2 ins. wide at the sills. From the bottom of the sill over the top of the trolley board the car is 8 ft 9 ins. high. The first point of novelty which strikes the observer is the fact that the car has a regular steam car roof; in this case the framing of the car runs out to the vestibule. The vestibule itself is of the standard three-window type, and is closed at the sides by gates and by curtains which come all the way to the floor. The platforms are not intended for passengers and are without seats. The car is also built without bulkheads, so that the platform and interior of the car are all in one compartment except for the low partition and spindle back of the stationary seats at the end of the car. There are seven seats with reversible spindle backs.

The arrangement of the car without the bulkhead to some extent necessitates the use of a steam car roof, because the vestibule takes the place of the bulkhead as a member of the framing and must be connected with the plates and frame of the monitor in such a way as to make a solid structure. In the arrangement described, the motorman in stormy weather is as completely protected as the passengers. When the curtains are drawn down on the platform the gates fold against the stationary seat. The trimming throughout is of bronze, the head lining of decorated three-ply white birch. The wheel boxes are of metal.



OPEN CAR WITH VESTIBULES

The seats are fitted with the round-corner seat end panels. There are radial draw-bars, two Brill sand-boxes, two Dedenda gongs and two electric headlights. The wheel base is 7 ft. and the wheels are 33 ins. in diameter with 2¼-in. tread and ⅞-in. flange.



SINGLE-TRUCK CAR FOR ISLE OF THANET

New English Works

W. A. McGuire, president of the McGuire Manufacturing Company, Chicago, has returned from a two months' trip in England, where he has been making arrangements for the manufacture of the McGuire trucks and other specialties. Although the company's material can thus be supplied to the English trade at a less cost, the move was not taken for economical reasons alone, but because, in Mr. McGuire's opinion, the English people prefer, wherever possible, to purchase articles of home manufacture. A factory is to be built, and until its completion all orders which require immediate attention will be filled from Chicago, as it is thought more advisable to get the business into activity at once, and sacrifice the large freight expense, than to lose the time which would

be required for the building of the plant. The railway men of England are already conversant with the company's products, but its genial leading salesman, W. J. Cooke, will spend six months in the country making their acquaintance. The London offices are at present located at 5 Warwick Court, High Holborn, W. C.

An Automatic Air Brake for Electric Cars

In the Knell air-brake system several good points are manifested. The construction of the apparatus is simple, and there is nothing that is liable to become damaged, get out of order or wear out. The durability of the brake is further insured by having the moving parts run in oil. The accompanying half-tone illustrates the compressor with the upper half of the dust-proof gear case removed. Since the compressor works only when the car is in motion, the action is practically noiseless, and special precautions have been taken to muffle the exhaust.

A diagram showing the application to a car is also given. The hose is attached to the upper end of the compressor, and the air is piped in the ordinary manner to the reservoir, from which it is released through a pipe to the brake cylinder by an ingenious device under the control of the motorman. The force is applied from the brake rod to the brake shoe in the same way as with the ordinary hand-brake. The brake rod is attached to the same chain that operates the hand-brake, and does not interfere with the use of the hand-brake. When the brake is applied with air the hand-brake chain loops down, and when the brake is applied by hand the air-brake chain loops down.

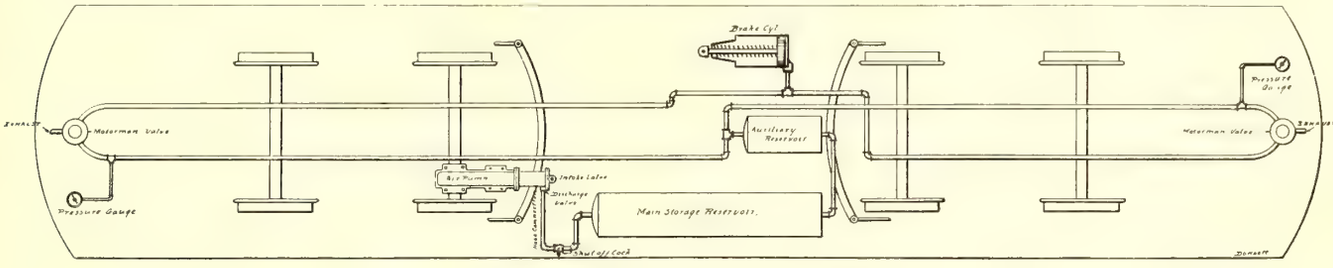
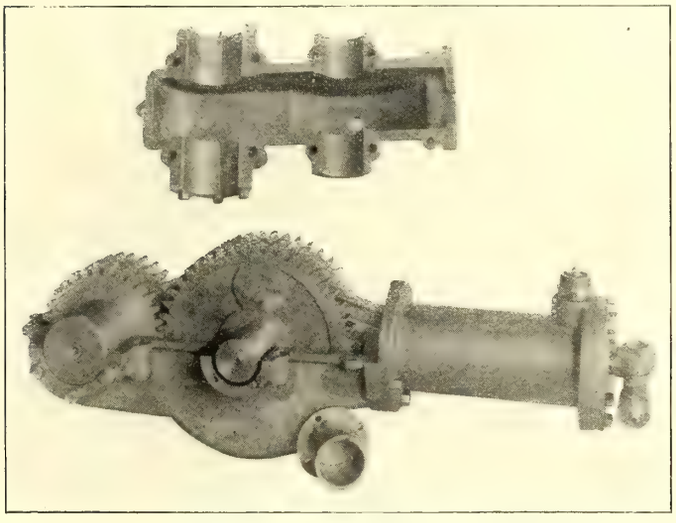


DIAGRAM OF BRAKE APPLIED TO CAR



AIR COMPRESSOR WITH GEAR CASE REMOVED

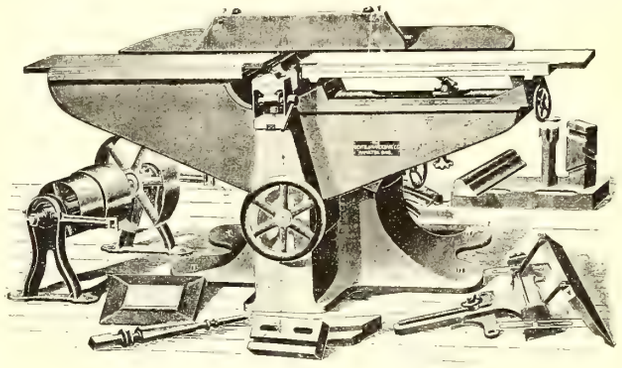
The device shown at the front end of the compressor contains an automatic cut-off valve. The mechanism of this valve is such that a uniform pressure is maintained in the reservoir. When the pressure in the reservoir attains the desired amount, usually from 60 lbs. to 80 lbs., the automatic valve goes into operation and holds the pressure in the reservoir at that point until air is released from the reservoir and carried to the cylinder operating the brake.

During the time that the air from the reservoir is maintained at the desired pressure by the action of the valve the compressor is released from all duty, simply working back and forth, but exerting no pressure against the air as maintained in the reservoir. The compressor is, during this time, simply pumping into the atmosphere through an open port in the automatic valve and sustains no appreciable amount of wear. As soon as the pressure in the reservoir has been reduced by an application of air to the pipes leading to the brake cylinder, the automatic valve is released, and immediately the compressor goes into operation and in a few revolutions raises the pressure to the maximum amount, when the valve again acts and the pressure is maintained in the reservoir until it is again reduced by another application of air to the brake cylinder. There is thus a constant supply of air always at the motorman's command requiring no attention on his part.

Brakes of this design have been in use in Battle Creek, Mich., Indianapolis, Ind., and Buffalo and Rochester, N. Y., and a number have been purchased for use on interurban lines running into the former city and Elmira, N. Y. They are manufactured by the Knell Air Brake Company, Battle Creek.

An Improved Universal Wood Worker

The accompanying engraving illustrates a solid universal wood worker, which is one of the latest forms brought out by the Bentel & Margedant Company, Hamilton, Ohio. The machine is supplied with three adjustable working tables, which can be raised or lowered by means of screws and hand-wheels in a most satisfactory manner. Three bearings are provided for the mandrel, so that the driving pulley may be placed between the last two, and does not overhang. This gives much better service, and saves the journals. The mandrel in the 9-in. machine is 1½ ins. in diameter, and made of hammered crucible tool steel. It is not filed, but is turned down and ground to a perfect surface. The firm, square column which rises from the heavy base is cast in one piece with the frame. The front of this column is provided with two vertical dove-tail slides and adjusting gibs. The table bracket carries two tables, which raise and lower simultaneously by means of the raising screw, and thus greatly facilitates the adjustment. The third table moves independently, and is used principally for resting the adjustable planing fence and bevel rest. At the back of the supporting column, when so desired, is placed a horizontal boring and routing machine, with the necessary supporting table. The boring tools are chucked onto the protruding end of the mandrel.

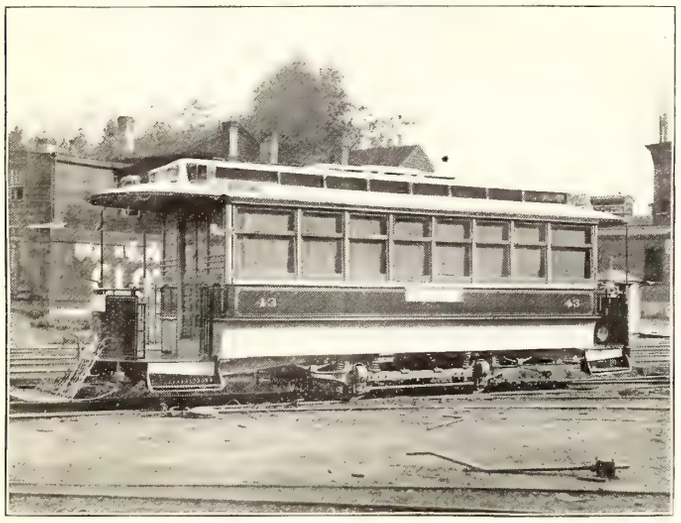


UNIVERSAL WOOD WORKER

This machine is one of eighteen varieties made by the Bentel & Margedant Company. It is a labor saver, and can be used on all kinds of wood working, such as rip or cross-cut sawing, gaining, plowing, panel raising, cornering between ends, etc., etc., so that it is not likely to stand idle in a shop. The front tables are 12½ ins. wide, including the recessed slide-way, and 6 ft. 10 ins. long, and will plane a board 9 ins. wide.

Cars for the Havana Electric Railway

The Jackson & Sharp Company, Wilmington, Del., are making weekly shipments of closed-car bodies to Havana for the Havana Electric Railway. Through its general manager, G. F. Greenwood, the railway company placed an order some weeks ago with



NEW HAVANA CARS, EXTERIOR

the Jackson & Sharp Company for sixty car bodies, and later on for fifty more, to be delivered at the rate of ten per week. Nearly all the cars have been shipped, and the balance are now awaiting shipment, or rapidly approaching completion.

The interior and exterior views, which are given herewith, will give a good idea of these cars. They are 20 ft. long in frame, and 29 ft. 6 ins. over platforms. The sash in each window is double,

NEW HAVANA CARS, INTERIOR

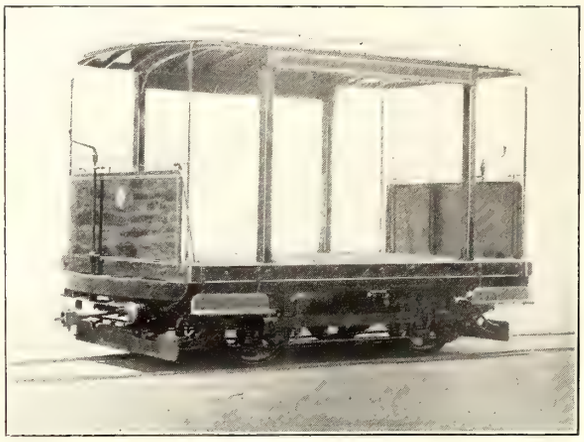
the upper sash being permanent and the lower sash made to drop, thus affording a very large opening. The interior is finished in cherry in neat design. The seats are of the Walkover type, covered in rattan, and are arranged eight on each side, thus giving a seating capacity of thirty-two passengers. Open platforms are used, fitted with the Wood gates. The under frame of the car, as well as all platform timber, is made of yellow pine, and the bracing is done in the most substantial manner. The exterior is painted with English vermillion and cream decorated in gold, making a very showy and handsome appearance.

When the cars are completed the platforms, dashers and canopies are taken off and placed inside, and the car is then boxed whole, and shipped by steamer to Havana. As the boxes are so large they have to be carried on the deck of the steamer, and ten cars are all the largest ones can take, even by greatly crowding the deck space. The Jackson & Sharp Company expects to make the final shipment in about two months.

Second-Class Funeral Car

The popularity of funeral cars in Mexico and the attention which is being paid to them in this country shows that the subject is one that deserves the attention of street railway managers. The car illustrated is one of a large order shipped within the present month to one of the Mexican railways from the works of the J. G. Brill Company.

It is 13 ft. long by 8 ft. 2 ins. wide, and is mounted on a No.

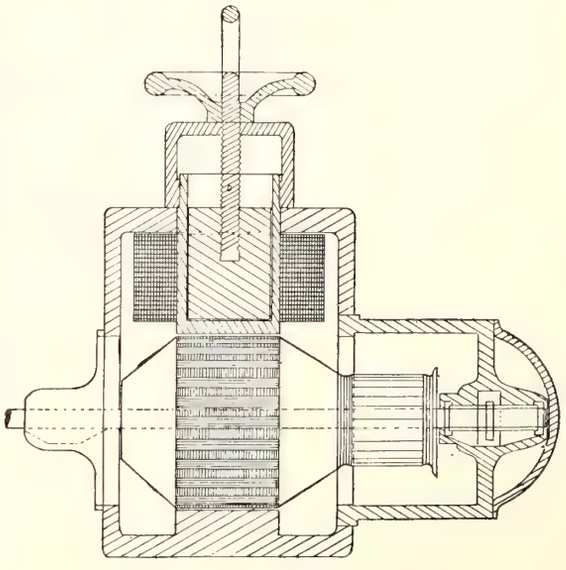


SECOND-CLASS FUNERAL CAR

21-E truck with a 6-ft. 6-in. wheel base. The road is standard gage, 4 ft. 8½ ins.; the cars are fitted with two G. E. 1000 motors so that they could haul a considerable number of trailers if necessary. The weight of the car without the motors is 7860 lbs. Radial draw-bars are used with angle-iron buffers. A step is placed at each corner of the car. The roof is supported by four stout corner posts, which are strengthened by wrought iron corner braces. The decorations for the car consist of black curtains, draperies, etc., which are furnished and put on by the company. There are also crucifixes and other religious decorations. These cars take the place of the hearse in American cities, and as the company furnishes transportation for the mourners as well as for the coffin, the revenue derived from this source is a large one.

Electric Street Railway Track Drill

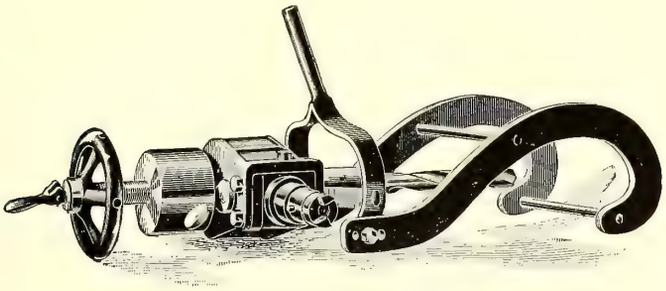
A tool of this kind, taking its power from the trolley wire and doing the work in a fraction of the time required by hand, should certainly appeal to everyone interested in street railway construction.



SECTION OF MULTI-SPEED MOTOR

From the fact that this device is used on a grounded circuit and usually handled by unskilled workmen, the motor require-

ments are very exacting. It must be practically dust and water proof and unbreakable, simple in construction, but of high efficiency; in fact, constructed specially for this kind of service. The Stow Manufacturing Company, of Binghamton, has been working along this line for years, some of its earlier designs having been previously illustrated in these columns. Several of the more primitive type have been in active service for the past four years, and are still in good working order, but practical use has from time to time developed faults in construction which, as fast as discovered, have been corrected. The invention of the



AUTOMATIC TRACK DRILL PRESS

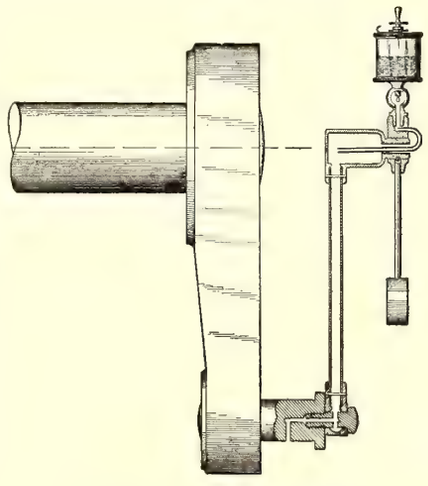
multi-speed motor has aided greatly in perfecting this apparatus, and while no doubt further improvements will suggest themselves, the company has no hesitation in stating that in its present form the combination of Stow flexible shaft and iron clad electric motor is as near "fool proof" as any electrical device on the market, and that no appliance used in street railway construction will pay a larger dividend than this.

The cut showing a cross section of the motor illustrates the extreme simplicity of its construction, and also the method of speed regulation. By simply raising and lowering the soft iron plunger in the hollow field by means of the hand wheel on top of the motor, the speed can be varied even to the fraction of a revolution. The motor is self contained, no outside speed regulator or starting box being required, a most desirable quality in a portable motor.

The automatic track drill press is a most valuable tool to use for rebonding. As shown in the illustration, it consists of a double hook, from the end of which the drill is thrust forward. This hook can be adjusted to the track or detached therefrom in a moment, which allows it to be used while the road is in operation with but little interference to traffic.

A Pendulum Crank-Pin Oiler

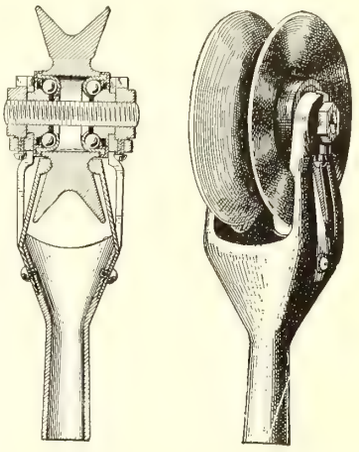
The Nugent patent pendulum crank-pin center oiler accomplishes its purpose without stuffing-boxes or packing of any kind. Neither is there a mechanical connection with the floor, wall, railing or any stationary part of the engine, as seen by reference to the accompanying cut. The tube through which the oil runs from the cup to the crank-pin is fixed on the crank-pin, so that one end is always central to the engine shaft. On this latter end is journaled an oil-cup support weighted with a pendulum bob which keeps the oil cup always stationary and right side up. In case it is desired to flood the crank-pin with water or cylinder oil, as in the case of a hot bearing, the oil cup can be taken off while the engine is running at full speed and the nozzle of a hose applied. It is claimed by the manufacturer, with apparently good foundation, that water applied to the outside of a hot bearing contracts the brasses so that they bind and make matters worse. By pouring water into the regular lubricating channels, the crank-pin is cooled first and there is less tendency to bind. Where a pressure oiling system is in use the connection can be made directly to the pendulum to which the oil cup is normally attached. The E. P. Allis Company, C. & G. Cooper Company, Filer & Stowell Company, Newburgh Ice Machinery & Engine Company, I. & E. Greenwald Company, St. Louis Iron & Machine Works, Ingersoll-Sergeant Drill Company, Vilter Manufacturing Company, William Tod & Company, Bass Foundry & Machine Works, Fraser & Chalmers, Griffith & Wedge Company, and a great many others use the Nugent center oiler exclusively. The device is made by William W. Nugent & Company, Chicago.



IMPROVED CRANK-PIN OILER

The Ball-Bearing Trolley Wheel

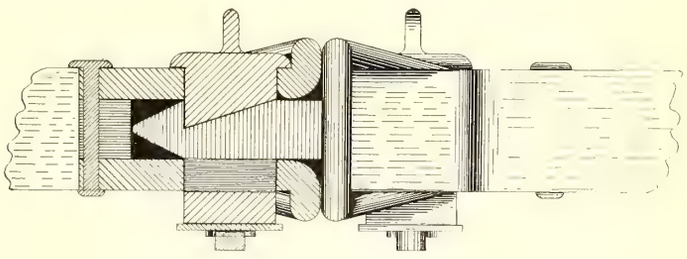
The trolley wheel illustrated in the accompanying cut is designed to transmit the current in an efficient manner with as little resistance of rotation as possible. The friction of the wheel on its axle is greatly reduced by the introduction of a ball bearing within the two arms of the harp. The balls are held in place by cups made of steel stampings, and revolve against cones of hardened steel, which are screwed upon the axle. Locking nuts are provided at either end of the axle, which provide against the bearing becoming loose. Springs are screwed in the bottom of the harp and press against the wheel to better facilitate the passing of the current, but the pressure of these springs against the surface of the wheel is too light to materially detract from the easy-running qualities of the ball bearings. This device is made by the Akron Trolley Wheel Company, Akron, Ohio.



BALL-BEARING TROLLEY WHEEL

A New Automatic Coupler

An extremely simple, practical and substantial automatic coupler for electric railway service of all kinds is about to be put out by the Auto Appliance Company, of Chicago. It would be hard to imagine anything more simple than the design of this coupler. There are only two parts to the coupler proper. As seen in the accompanying illustration, which represents a vertical section through the coupler, the draw-bar head, instead of being provided with a pin as in most couplers, has a slotted block through which the link passes. This link has a catch on each end, and as soon as it has fully entered, the slotted block drops down by gravity and the coupling is made. The parts are machined so that the clearance is small between draw-heads when the cars are attached together. The links are cut from bar steel and the draw-heads and locking blocks are of malleable cast iron. The simplicity of the coupler renders its action easily understood by a glance at the illustration. It is the invention of T. I. Duffy, of the Auto Appliance Company, and will be exhibited at the National Street Railway Convention.



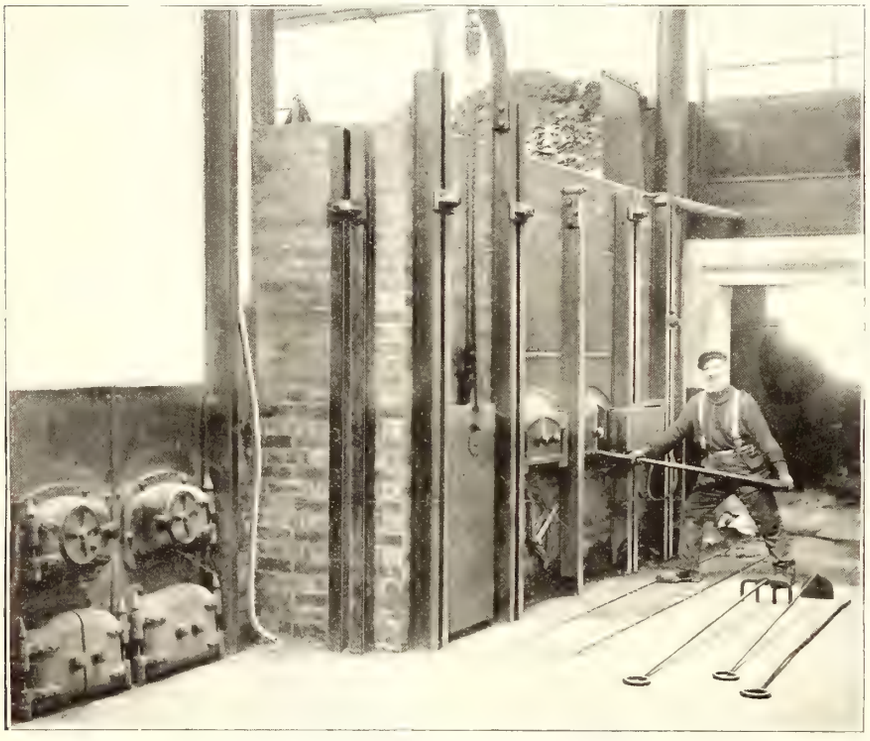
A SIMPLE CAR COUPLER

Refuse Destructor at Llandudno, Wales

One of the most interesting features about the recent installation of an electrical plant at the beautiful health resort of Llandudno, in Wales, is the refuse destructor that has been adopted by the Urban District Council. An illustration is shown of a destructor cell, which, though it looks to all intents and purposes like an ordinary furnace, is specially constructed to burn the refuse from the town. The particular form of destructor used is the Beaman & Deas destructor, now controlled and manufactured by Meldrum Brothers, Limited, of Manchester.

The entire scheme may be described in a few sentences. The refuse of the town, upon arrival at the works, is charged into the destructor cells, where it is burned by the aid of forced draft; the flames and hot gases resulting from the combustion of the refuse in these cells are led under large water tube boilers; the steam generated in these boilers is conveyed to high-speed steam engines coupled direct to powerful dynamos by which the electricity is generated; the current thus produced is distributed as required throughout the town, serving arc lamps of 1200 cp on the promenade and other parts of the town, and incandescent lamps in the hotels and private residences.

In the destructor cells now in operation at Llandudno the difficulty of burning the refuse without creating a nuisance has been overcome by a novel and compact combination of simple elements. The charging opening and the drying hearths of the cells are as far removed as possible from the entrance to the flue, in order that the green gases arising from the drying process must pass over the fire itself. Ample space is also provided for the mixing of the gases, while finally the double construction of the furnaces—that is the arrangement of the cells in pairs—and the alternative system of working are calculated to make assurance doubly sure in regard to the destruction of any fumes of a noxious character which might otherwise possibly escape into the flues. It is impossible with any destructor cell to ensure a continuous high temperature in the cell proper. The cell must be more or less open to be charged and clinkered and the charge must be started from a comparatively cool condition. The Beaman & Deas destructor is no exception in this respect; therefore, unless special provision is made to prevent them, comparatively green gases must pass into the atmosphere. In this destructor each cell of a pair acts alternately as a fume cremator to the other; when the one cell is comparatively green the gases from the other are at their hottest, and with ordinary refuse a minimum temperature of 2000 degs. F. is maintained in the combustion chamber where the gases unite, provided only that a reasonable supply of refuse is maintained. Finally the combustion of the refuse is aided by forced draft generated by a special type of fan, the object being to destroy the refuse quickly and at the highest convenient attainable temperature; that is to say, a temperature calculated to decompose and render harmless and innocuous all the products of combustion.



REFUSE DESTRUCTOR AT LLANDUDNO

It is interesting to note that the whole scheme was examined and reported on by A. H. Preece, of the firm of Preece & Cardew, who stated that the destructor was doing its work in a most satisfactory manner, and had frequently to get rid of such unpromising material as fish and horses. Even with such refuse to use as fuel the cost, per Board of Trade unit, had been reduced to under ½d., while all noxious gases had been entirely consumed, and, though the destructor had been working for six months, at the time of the report, no complaint of any kind from adjacent property owners had been received.

Recent Rail Bond Tests Made in Paris

To determine which was the best method of rail bonding, very careful and thorough tests of the leading types of rail bonds were made in July by experts of the French Government at the Ecole d'Electricité in Paris, and the formal report has just been issued. To insure fairness each bond was applied by a representative of the manufacturing company who was present at the test. In each case the current and potential difference was measured, from which the resistance was calculated. In each test the same pair of grooved girder rails were used, weighing about 80 lbs. to the yard, and point plates were not used.

Following is a detailed description of tests:

Test No. 1.—Edison-Brown plastic copper rail bond of 0000 size; length, 76 mm; height, 38 mm; thickness, 3.2 mm. This bond was merely laid by its own weight, so that one half touched the amalgamated spot upon one rail and the other half a similar spot upon the other rail. A current of 1915 amperes was passed from rail to rail through this bond with a potential difference of 0.0234 volts; calculated resistance, 0.0000122 ohms. After five minutes the current was 1806 amperes, potential difference, 0.0233 volts, and calculated resistance, 0.0000129 ohms. After the passage of the current for five minutes through this bond, the finger could be held upon it without discomfort.

Test No. 2.—Conditions the same as in the first except that two 0000 Edison-Brown plastic copper rail bonds were used. In this case the current was 1915 amps.; difference of potential, 0.0127 volts, and calculated resistance, 0.00000666 ohms. No apparent heating above temperature of room.

Test No. 3.—Conditions the same as before except that one Edison-Brown plastic copper rail bond 000000 size was used. Length, 89 mm; height, 44.5 mm; thickness, 4.7 mm. The current was 1910 amperes; the difference of potential, 0.0114 volts, and the calculated resistance, 0.00000598 ohms. No appreciable heating above temperature of room after five minutes' passage of current through the bond.

Test No. 4.—Conditions the same as in No. 3, except that two Edison-Brown plastic copper bonds 000000 size were used. The current was 1880 amperes; the difference of potential, 0.00678 volts; calculated resistance, 0.0000036 ohms.

Test No. 5.—Copper bond of 00 size set in rails by driving steel pin in the longitudinal hole in the terminals. Diameter of conductor 9.3 mm; diameter of terminals, 16 mm. In this case the current was 1610 amperes; difference of potential, 0.75 volts, and calculated resistance, 0.00046 ohms when the circuit was closed. After five minutes the current was 1530 amperes; difference of potential, 0.83 volts, and calculated resistance, 0.00054 ohms. After the current had passed for two minutes it heated the bond to redness.

Test No. 6.—Two copper bonds aggregating the same section as in test No. 1; these bonds were set by driving a steel pin in the

longitudinal hole in the terminals. The diameter of each bond was 9.3 mm; diameter of bond terminals, 16 mm. In this case the current was 1805 amperes; difference of potential, 0.278 volts, and calculated resistance, 0.000154 ohms at the start. After five minutes and twenty seconds the current was 1620 amperes; difference of potential 0.37 volts, and calculated resistance, 0.000219 ohms. After the passage of the current during two minutes and five seconds the temperature of the bonds was at steam heat.

Test No. 7.—In this test a certain type of flexible copper bond with solid terminals was used, which had exactly the same section as the bond in test No. 1, viz.: 0000; diameter of terminals, 22 mm. The current was 1830 amperes; the difference of potential, 0.119 volts, and the calculated resistance, 0.000065 ohms when the circuit was closed. After five minutes the current was 1750 amperes; difference of potential, 0.1213 volts, and calculated resistance, 0.0000659 ohms; temperature, steam heat.

Test No. 8.—One end of a permanent copper bus-bar on the switchboard in the laboratory of Ecole d'Electricité was connected to an adjoining bar by the experts of the school, in the best French manner. The other end of the same bus-bar with contact of the same area and with same number and size of bolts, was made up with the Edison-Brown contact alloys. With a current of 1760 amperes the loss at the first joint was 0.048 volts; the loss at the plastic alloy joint in series with the first was 0.0008 volts, or sixty times as good.

Test No. 9.—A current of 202 amperes was passed through a copper rod 11 mm in diameter. Difference of potential measured between two points about 10 cm apart on the rod was 0.0038 volts; calculated resistance, 0.0000188 ohms. The rod was then sawed in two, the ends were amalgamated and a small amount of plastic alloy was placed between the ends in contact with each other. With a current of 206 amperes the difference of potential was .0045 volts, and the calculated resistance, 0.0000218 ohms. The length of a bar of unbroken copper, to give the same resistance, measured 11.5 cm. Resistance of the rail per meter, 0.0000564 ohms.

Overhead Material for Electric Railways

The growing demand existing for overhead material has caused many concerns to specialize this branch of the electrical railway supply business. This has naturally raised the standard of excellence in regard to the apparatus in question, and the imposed conditions have been met by the older firms in the trade by a quality of output that can hardly be bettered. This excellence of quality includes not only improvement in the metal and insulation used, but the invention of new machinery and the employment of skilled labor has rendered practicable the securing of the best possible workmanship and finish.

A large and well known firm which has recently begun to pay special attention to overhead construction is that of F. H. Lovell & Company, New York and London. In its business dealings regard is always had for the effect of first cost on electric installation, but it never subordinates quality to price. Having its own foundry and machine shops the company is dependent upon no outside sources for its supply of castings. It is enabled thus to follow through, from start to finish, the making of its goods, and also to give intelligent and exact promises regarding the delivery of material. The factory is situated in Brooklyn. The entire plant, including machinery, apparatus, recipes, etc., of the New York Electrical Works, has been purchased, which enables the Lovell Company to make the same insulation as was used by the former occupants. This insulation has stood all tests, including those of time and use. It has given satisfaction wherever introduced, and has been employed extensively on many large systems, such as the Brooklyn Heights Railroad Company's. Overhead material, in which this insulation is used, is claimed to be always reliable, the dependence which can be placed upon it being undoubtedly due to the great care taken in its manufacture and the strictness of the inspections and tests to which each piece is subjected.

That promptness in acknowledging and executing orders is absolutely essential, especially in cases where material is desired for export, has always been recognized by the company. Its customers may, therefore, rely upon its despatch and reliability. From the thorough knowledge of overhead work possessed by the men in the company's employ it is assured that its products will continue to be manufactured along the most modern lines, and by thus keeping abreast of the times it will be enabled to advise in all improvements which are taking place from time to time in overhead construction.

An Efficient Electric Arc Headlight

That a headlight giving greater illumination than the best forms of oil headlight is a necessity on interurban and suburban lines operated along public highways is now admitted by the majority

PHOTOGRAPH TAKEN BY LIGHT FROM ARC HEADLIGHT

of the railway men in charge of such lines. The interesting illustration on this page is a reproduction of a night photograph taken by the Wagenhals Arc Headlight. The headlight was on one of the cars of the Southern Ohio Traction Company, which connects the cities of Cincinnati, Dayton and Hamilton, and the view shows a position of one of the interurban tracks of the company. Where a motorman can have as well lighted a track by night as by day there is little or no excuse for collisions or similar accidents, and a glance at the engraving will show the flood of light which is constantly in front of the car when this headlight is used. It is claimed that on straight track the road is illuminated for sometimes half a mile in advance. The arc lamps in these headlights are easily operated and not liable to get out of order. The voltage is regulated by a German silver resistance substantially built and placed out of the way under the car. The current required by the lamp is from 3 amperes to 4 amperes, which is quite low for this class of apparatus.

The Wagenhals Electric Arc Headlight is made by the Dayton Manufacturing Company, Dayton, Ohio.

New English Car Company

The British Electric Car Company, Limited, with a capital of £50,000, has just been organized with the following directors: A. K. Baylor (chairman), William M. Murphy, George J. Jackson, Jervis W. Barber and W. S. Laycock. The company has been formed with a view of carrying on the business of manufacturers of and dealers in electric cars and other rolling stock, having its headquarters in London. It is intended to devote special attention to the supplying of cars for electric tramways and light railways.

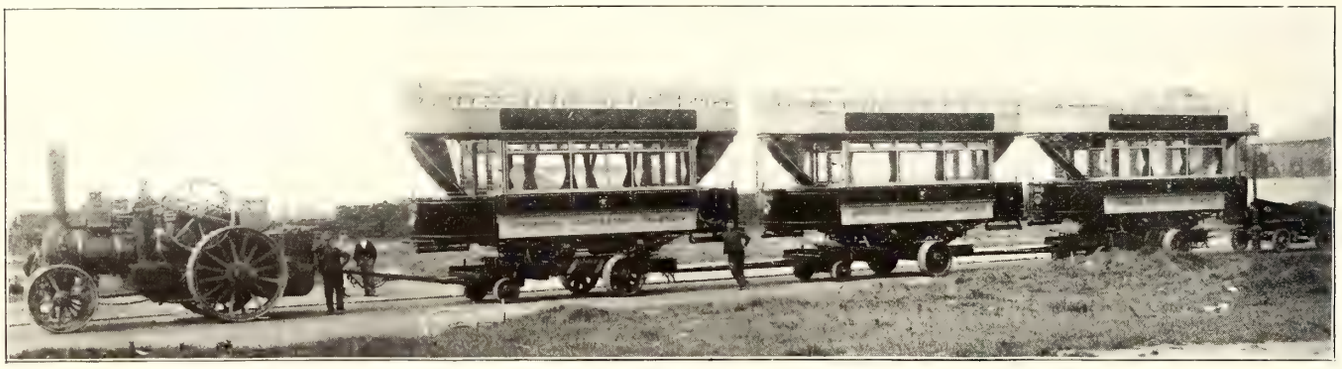
The company has secured a site for the erection of works at Trafford Park, Manchester. The location is a particularly suitable one for its purposes, as it is in direct communication with the various railways serving Manchester, and is at the same time on the banks of the Manchester ship canal. It is proposed to place

the building contracts at once so that manufacturing or assembling facilities will be ready in a short time.

A. K. Baylor, the chairman of the company, is well known in both England and America, having been for several years manager of the traction department of the British Thomson-Houston Company, before which time he was associated with the General Electric Company, of New York. The other directors are also well known in electrical and railway work in England, the whole forming a particularly strong board for the purposes in view.

Traction Engines for Shipping Electric Cars

The interesting photograph which is presented herewith shows the method in which electric motor cars are shipped by the Electric Railway & Tramway Carriage Works, Limited, Preston, England, to fill the contracts of Dick, Kerr & Company, Limited, with the Corporations of Liverpool and other towns within a radius of 40 miles to 50 miles from the works. It will strike American readers as curious that such a method should be at once much cheaper and more expeditious than shipment by rail. The fact of the matter is that, although these works have excellent railroad connection with the tracks of two of the great English railroad systems, the magnificent country roads which exist throughout Great Britain enable them to ship by road-traction engine with considerable advantage. As will be noted from the illustration, the cars are mounted on small, special, wide-wheel road trucks complete, with the exception of the upper deck trolleys, the road bridges permitting the passage under them of any article not more than 15 ft. to 16 ft. in height above the roadway. These cars, tested on the company's tracks after being completely equipped at Preston, simply have the trolley stands and poles removed before being run on to the road trucks. After their arrival at their destination, all that is necessary is to run them down on the tramway track, replace the trolley and start off under current. The ordinary rate of shipment under these conditions is about three complete cars per day. It cannot be said that this appreciation of existing facilities shows any lack of enterprise on the part of the English engineers.



SHIPPING ELECTRIC CARS BY TRACTION ENGINE

A Prosperous New England Car Company

The Laconia Car Company Works, of Laconia, N. H., with principal offices in Boston, Mass., has, under the efficient management of Col. E. H. Gilmour, gained a most enviable reputation for the handsome types of electric cars built by this company, and particularly for the excellence of the work in every detail. Laconia cars have a reputation in New England second to none, and, although the company's plant at Laconia is the largest and most complete car-building works in New England, its capacity has been continually taxed for the past year in filling orders for that section alone. In taking charge of the Laconia plant the first move made by Col. Gilmour was to equip it throughout with the very best and latest types of machine tools. The company is enlarging its factory very considerably, and with a largely increased capacity hopes to be able to extend its business beyond its present limits. The double truck designed and made by it is said to have given unqualified satisfaction wherever introduced. These trucks are equipped with double-plate wheels of the company's own make, the wheels being practically of the steam-car type, much stronger and more durable than the ordinary wheel and better adapted for high speed.

Lythite for Power Stations, Car Houses, Etc.

Lythite is the title of a cold-water paint now being put on the market by the Frank S. De Ronde Company, of New York. It is a dry powder, which, when simply mixed with cold water, produces a perfectly pure liquid paint. It is especially recommended for coating the walls, ceilings, etc., of power houses, engine rooms, car houses, storage rooms, and hosts of other purposes. Lythite is made in a pure, lustrous white and in twenty-four handsome colors. It is claimed to last ten times as long as whitewash and is guaranteed not to crock, rub or peel off. It also gives a fine, firm, hard surface, that will last for years, and is both fire- and weatherproof. Another important advantage claimed for it is that it sets very quickly and when dry is extremely hard, at the same time retaining its elastic properties. To large surfaces this paint can be most economically applied with De Ronde's ideal painting machine. This is a unique apparatus, having the power air compressor, tank and all combined, ready for use; at the same time it is compact and simple in construction.

Another very valuable use for Lythite is as a priming surface over which oil paint and varnish are to be applied. It makes an excellent foundation and base for a priming or rubbing down coat. Recent tests have also shown its value for rubbing down. One railway company which had used the material for this purpose reports that Lythite takes the place, without a filler, of two coats of rough stuff and one of filler rubbed down with pumice, and that it gives a remarkably smooth finish under the action of pumice stone and water. The colored Lythites have been used extensively for the outside coat of car houses and buildings of every description.

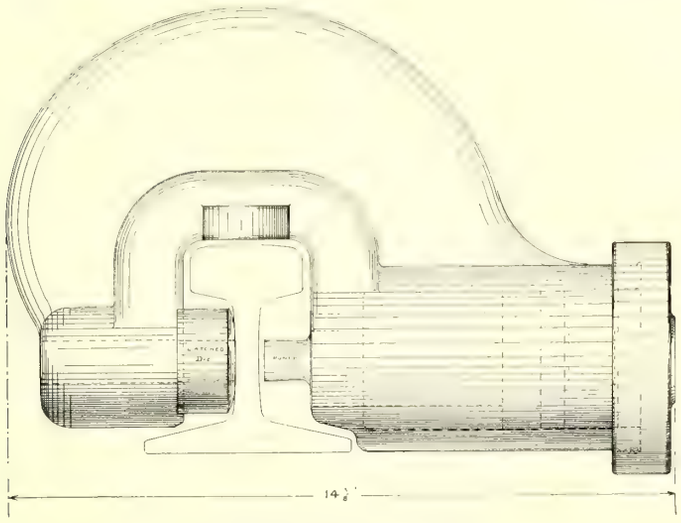
Where a cheaper sanitary coating than Lythite is required, the De Ronde Company supplies National Wall Coating. This latter material is only adapted for inside work, while the Lythite can be used for either inside or outside purposes. The Wall Coating possesses many of the good properties of Lythite, however, has the same intense whiteness, and is also fire resisting. This product is also made in twelve delicate tints, as well as white.

The treasurer and general manager of the company is Frank S. De Ronde, who is well known in electrical circles and is an authority on insulating materials and paints of every description. The other officers are: John A. Hall, president; Col. Sheffield Phelps, vice-president, and Charles D. Bailey, assistant manager.

The Sunderland (England) Corporation Electric Tramways were formally opened on Aug. 15. This is one of the most important undertakings in the North of England, Sunderland having a population of from 150,000 to 175,000. The present scheme, upon which work was commenced a year ago, included the construction and equipment of 15 miles of track. The contract for the complete equipment of the lines, amounting to about $700,000 in the present case, was placed in the hands of Dick, Kerr & Company, who constructed the permanent way and overhead systems and supplied the feeders and rolling stock, which consist of cars of the standard Preston type.

A New Hydraulic Rail Punch

The apparatus illustrated on this page is designed to furnish street railways with a convenient and efficient means of punching the rails. The device is but little over a foot in length, and is



HYDRAULIC RAIL PUNCH

used in conjunction with a small portable hand-pump. The entire weight of the complete equipment is about 80 lbs. The hand-pump or compressor is joined to the press by a flexible hose connection, which is attached to the end of the press cylinder by an ordinary coupler. The hardened steel die of the punch is made removable, and is dove-tailed, or latched, into the steel backing. This enables the frame of the punch to be conveniently placed over the head of the rail, while the die is removed, and allows of its easy adjustment. The punches and dies can be easily changed, and the machine thus readily adapted for installing bonds by pressure.

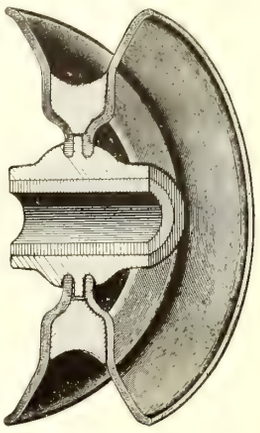
This improved form of hydraulic punch is controlled by the Morris Electric Company, of New York, and is being put upon the market by that company.

Electrical Traction in Liverpool

The Corporation of Liverpool has been proceeding very rapidly with the equipment of its electric installation, and by the end of this year will have reconstructed at least 100 miles of tramway route, and will thus be the first large city in Great Britain to be thoroughly equipped electrically. The current for the lines is obtained principally from the two large new generating stations which have been built for lighting and power, each having a capacity of 1200 hp. A very interesting feature of these new power stations lies in the fact that high-speed engines have been adopted, each engine having a nominal capacity of 1200 hp and 1500 actual hp. The engines were built by Willans & Robinson, of Rugby. They are direct coupled to 220-volt, 800-kw Siemens' multipoler generators, which are shunt-wound, so that they can be used for either lighting or power. These new power stations may be taken as excellent examples of English electrical engineering practice. There will probably be much comparison between them and the American practice, adopted in Glasgow, where the principle of joint supply at 500 volts is used both for lighting and tramway purposes and where both circuits are taken directly from the same generating sources. The use of these high-speed engines, which, to American ideas, seem abnormal for such large units, is also distinctly English, and the economy in this Liverpool system as compared with the Glasgow system will undoubtedly be watched with a great deal of interest on both sides of the water. The cities are practically of the same size, both under municipal control and resembling each other in many aspects. So fast has the Corporation been extending its lines in Liverpool that it has just extended the existing contract with Dick, Kerr & Company, Limited, for another hundred completely equipped motor cars of the improved Preston top-seat type, making a total of 425 which it has had from this firm.

An Economical Trolley Wheel

In designing the trolley wheel illustrated on this page the manufacturers have attempted to combine the merits of existing forms with some added improvements of their own. It was their intention to produce a wheel constructed on mathematical lines, which would have a maximum strength and a minimum weight, and which, while remaining inexpensive, would have a long life, without being destructive to the wire. The result of these attempts is the "Ideal" trolley wheel herewith shown.



IMPROVED TROLLEY WHEEL

The flanges of the "Ideal" wheel are made of a special, soft, cold-rolled and pickled steel. It is claimed that this steel will not become hardened or blistered by the electric arc or current, and will, therefore, wear the wire no more than if made of a soft bronze. These flanges are securely held in the hub, which is cast around them, as shown in the cut. As there are no screw threads to wear out, or nuts to work loose, there is no danger of the wheel collapsing. The material used in this hub is "Lumen" bronze, a patented alloy, controlled by the manufacturing company. Standard graphite bushings are employed as a bearing for the hub, the wearing tread of the wheel being of pure copper.

The "Ideal" trolley wheel is made by the Bierbaum & Merrick Metal Company, Buffalo, N. Y., and is extensively used on many railways. Its peculiar construction, recommending it to both theoretical and practical engineers, has led to its introduction, and its efficient service has retained it in favor wherever installed.

Compressed Air Cars in New York

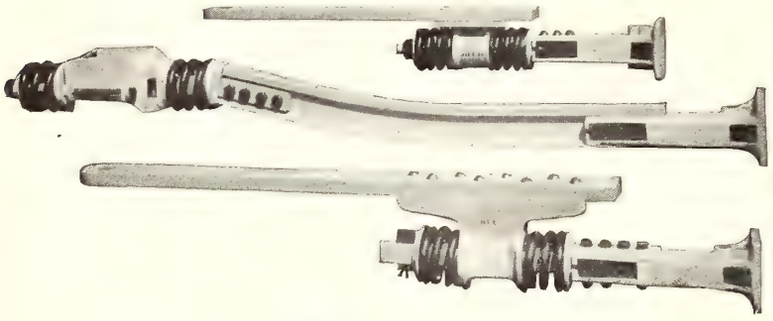
The new type of compressed air cars being used by the Metropolitan Street Railway Company, of New York, and manufactured by the Compressed Air Company, under the Hardie patents, have been put in operation on the Twenty-Eighth and Twenty-Ninth Streets line. The cars differ considerably in appearance from those formerly used, as will be seen from the engraving herewith. The chief feature of difference to the ordinary observer is the use of connecting rods. The motors, however, as well as the general method of using the air, is quite different from that formerly employed, as was fully described in the Street Railway Journal for August.

AIR MOTOR CAR IN NEW YORK

In actual service on the street a wooden screen, shown raised in the cut, covers the upper part of the truck and connecting rod, this having been considered more desirable for city service.

An Efficient Car Coupler

In elevated railway service, where cars are run in trains, and on those roads where trailers are operated, the question of car couplers is of considerable importance. The accompanying illustrations show some forms of coupler which have been in successful operation for a considerable length of time, and which are especially adapted to this class of service. The styles shown are



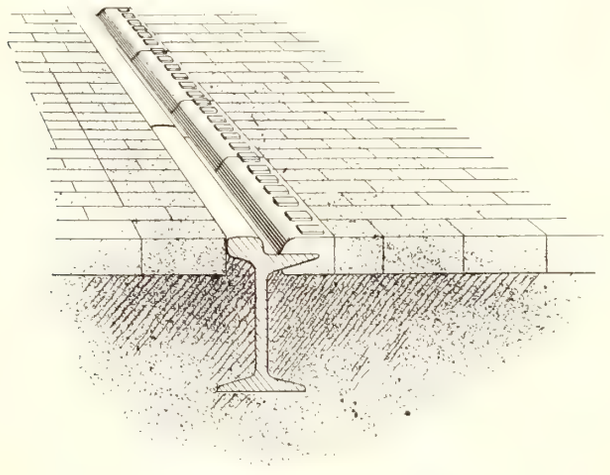
COUPLINGS FOR ELECTIRC CARS

three of the thirteen distinct patterns of automatic couplers made by the W. T. Van Dorn Company, Chicago, and represent the type used on the new Northwestern Elevated and the Lake Street Elevated of that city on trailer cars, the kind used on the same roads on motor cars, and a special form designed particularly for interurban service.

The Van Dorn couplers are giving satisfaction in many parts of the world. The company has lately been favored by orders from Yokohama, Japan, and Glasgow, Scotland, as well as from the Continent of Europe. Recently the Manhattan Elevated, of New York, and new elevated roads of Boston have begun the installation of this form of coupler on their cars.

An Improved Paving Block

The large number of roads now laid with the ordinary train-head girder rail have long experienced the troubles accompanying its use both from the wearing out of the adjacent pavement and from the damage to vehicle wheels. The device illustrated on this page converts the old-style rail into the standard full-groove



PAVING BLOCK FOR STREET RAILWAYS

section of rail, and places within the reach of every railway manager the means of making his track conform to the most modern practice. The application of the paving block to existing roads entails very little more work than the mere repaving of the street, no skilled labor being required or bolts used.

The engraving shows the invention used on brick-paved streets, although it is, of course, equally applicable to granite block or asphalt pavement. It is called the "Buckland Paving Block," and consists of an iron casting, grooved to receive the lip of the rail, and finished with ridges on the upper surface to give a foothold for horse traffic. By arranging the blocks so that they break joints with the rail an efficient secondary rail-joint is provided, and this property increases the value of the paving block to a very great extent.

These blocks have been extensively used in Springfield, Mass., for more than two years, and the result has been most satisfactory. The rail-joints have remained in most perfect condition, and the entire track has to-day the appearance of having been but recently laid.

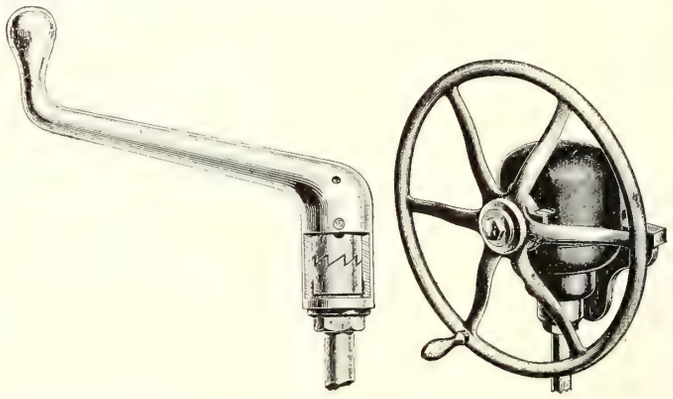
Considerable public indignation had been produced before its installation by the dangerous condition of the old girder rail, and it became necessary for the railway management to improve the condition of the track. The conversion of a section of the road to grooved rails by the application of the Buckland device was so successful that its general adoption soon followed.

A company has been organized in Springfield for the manufacture and sale of the Buckland paving block, and for contracting to do paving between the rails of street railways or general paving throughout the different cities and towns of the United States and Canada. It is called the American Street Railway Paving & Improvement Company, and is capitalized at $150,000, divided into shares of $100 each. The officers are: William P. Wood, Pittsfield, Mass., president; James D. Hunter, North Adams, Mass., vice-president; and C. Fred Smith, Adams, Mass., manager.

Ratchet Brake Handles for Street Cars

The "Beverly" ratchet-clutch brake handles and ratchet-clutch vertical brake wheels, which are herewith illustrated, have been manufactured by the Beverly Engine & Machine Company, of Beverly, Mass., for a number of years past, and have been in successful operation on many roads. The "Beverly" brake handles are simple, strong and reliable, and are made of the very best composition. The clutches are made of steel, and are machine cut, the workmanship and finish being of the best.

The ratchet brake handle resembles an ordinary, rigid brake handle. In the butt of the handle a steel ratchet clutch is held, and



RATCHET BRAKE HANDLE AND WHEEL

on the upper end of the brake staff the other engaging member is secured. The upper part of the clutch is movable, and the members of the clutch are held together, and the handle is secured to the staff by a lock-nut, screwed into the bottom of the handle butt. This is illustrated in the accompanying figure.

The ratchet-clutch brake wheels are intended for use on vestibule cars, and are, therefore, designed to be simple and powerful, while taking up but little room on the platform. The whole wheel projects only 10 ins. from the front of the vestibule. They are a combination of the ratchet of the brake handle and the brake wheel, placed so as to get the best results. The gearing gives a leverage equal to the diameter of the wheel used. Like the handles, they are made of the very best material throughout, the clutches being of machine-cut steel, and the gears of the finest quality.

These handles and wheels are in use by a number of the larger street car builders, including the Jackson-Sharp Company, Wason Car Manufacturing Company, Woeber Carriage Company, Briggs Carriage Company, Laconia Car Manufacturing Company, Duplex Car Company, and by the street railways in the cities of Boston, Philadelphia, Baltimore, Richmond, Brooklyn, Springfield, Providence and a large number of smaller towns.

The Price Friction Brake

The Price friction brake, which is manufactured by the Peckham Motor Truck & Wheel Company, is being rapidly introduced upon a number of electric railways. As its name implies, the application of the brakes is accomplished by means of the frictional resistance of two discs that are pressed together. Briefly, the device consists in having a friction disc *A* cast on one of the wheels, a corresponding disc *C*, provided with a sleeve *D*, mounted loosely upon the axle, a second sleeve *N*, secured firmly, and keyed to the axle, and a friction clutch, located between the two sleeves. The loose sleeve is provided with lugs, to which is secured a chain, which leads to the brake sway-bar, attached to the car body. As the wheels revolve, and as the pressure is applied to the end of the sleeve *D*, of the disc *C*, the chain winds around the sleeve and applies the pressure to both brake-shoes by means of the brake connecting rods. The power is applied to the friction discs, which are machine faced, by means of the clutch, which is operated by the motorman by means of a wire rope connecting the clutch with the brake staff.

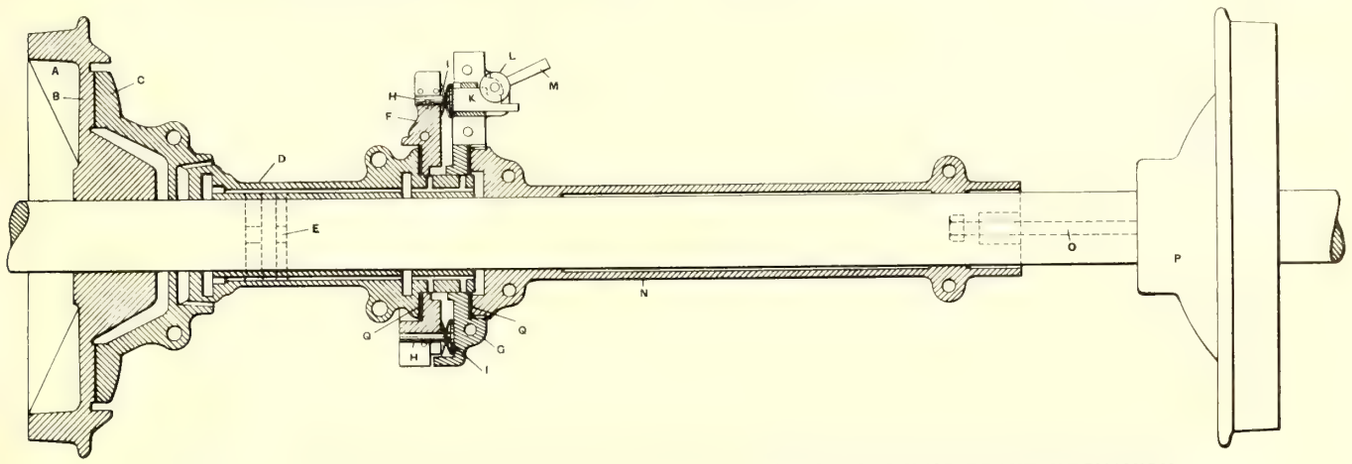


FIG. 1.—PLAN VIEW OF AXLE OF MAXIMUM TRACTION TRUCK, SHOWING BRAKE MECHANISM

The mechanism of the brake is clearly shown in Figs. 1 and 2, which show it as applied to one of the trailing axles of a maximum traction truck. Referring to the plan, Fig. 1, the engraving represents the parts in section, whereas, in reality, the surfaces so sectioned are the flat parting surfaces of one of the halves. The section lines are used in order that the eye of the reader may quickly and easily distinguish the metal surfaces from the open spaces.

The method employed to force the two discs together is extremely simple. The sleeve *N* is, of course, fixed on the axle, and turns with it. It is adjusted to the proper position longitudinally with the axle by means of the screw bolt *O*, that bears against the inside of the hub of the wheel *P*.

One end of the wire cable for setting the brake is attached to the brake staff. The other end is attached to the lever *M*. One quarter turn of the handle serves to apply the brake by drawing down *M*. This pushes against the disc *F* at the point *H*. This forces the loose sleeve against the wheel disc, and makes it turn with the axle, winding up the chain. The wear between the sleeves and the circular disc and yoke levers is taken up by the brass plates *Q Q*. Only one pressure piston is used, as at *K* the opposite fulcrum is held by a surplus of light springs. As the parts wear, an adjustment is made by turning the screw bolt *O*. The springs *I* serve as a cushion that softens the application of the brake, and tends to the avoidance of sudden gripping by causing the application of the pressure between the two discs to be gradual.

The brake, as thus constructed, is exceedingly sensitive, and can be so applied as to produce any desired amount of tension on the brake chain. At the same time this tension can be made very severe by a hard pull upon the staff lever. In some tests that have recently been made, the pull on the chain was raised to 2500 lbs., a tension that is far in excess of anything that the brake would ever be called upon to do. For ordinary working the intention is so to proportion the leverage that for a sudden emergency application of the brake, the pull on this chain should be from 800 lbs. to 1100 lbs., according to the weight and speed of the car and the load that is being carried.

The advantages claimed for this brake are, first, that the amount of brake-shoe pressure can be varied, so that it is properly proportioned to the weight on the wheels, using a higher pressure for a loaded than for an empty car. In this way it becomes quite possible to make as short a stop with a loaded as with an empty car, a condition that is quite impossible to meet in the case of a car upon which the brake-shoe pressure is constant under all variations of load.

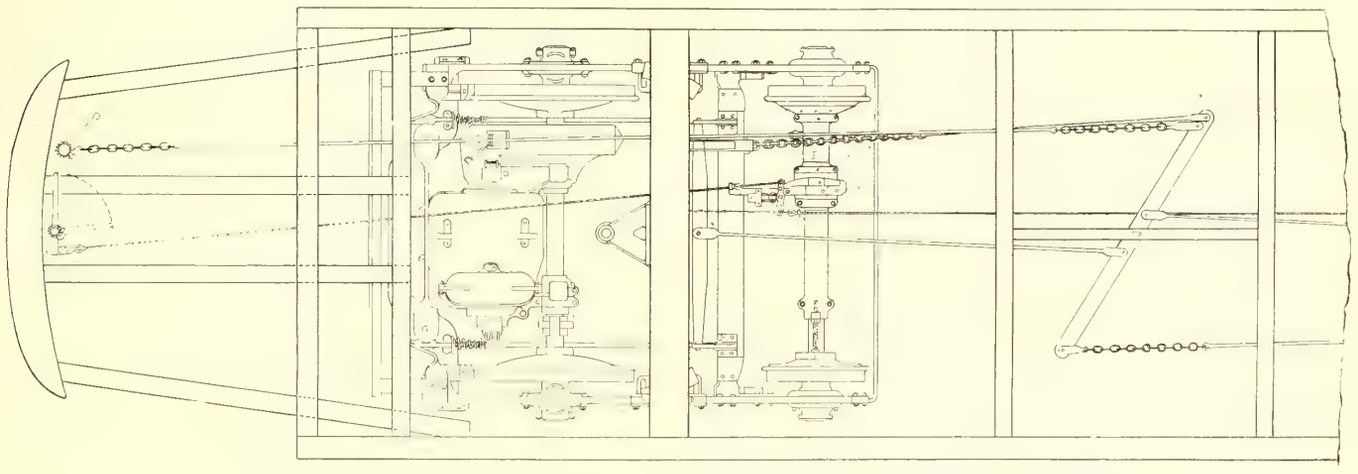


FIG. 2.—PLAN SHOWING APPLICATION OF BRAKE TO MAXIMUM TRACTION TRUCK

Secondly, the simplicity of the mechanism used is such that it is not likely to get out of order, and can be easily and quickly understood by the men who are to have charge and operate it. It requires no especial skill to apply it or to operate it, and hence the cost of maintenance is reduced to a minimum. In fact it has been found that one ordinary, unskilled man can easily take care of and

properly maintain fifty or more of these brakes, and that, too, when they are running on different divisions, so that a considerable amount of time is lost in going from one car house to another.

Thirdly, the power consumed in the application of the brake is taken from the momentum of the car itself, and thus assists in the stopping, and does not in any way call upon the electric generating machinery to do the work. It, therefore, avoids all the charges for

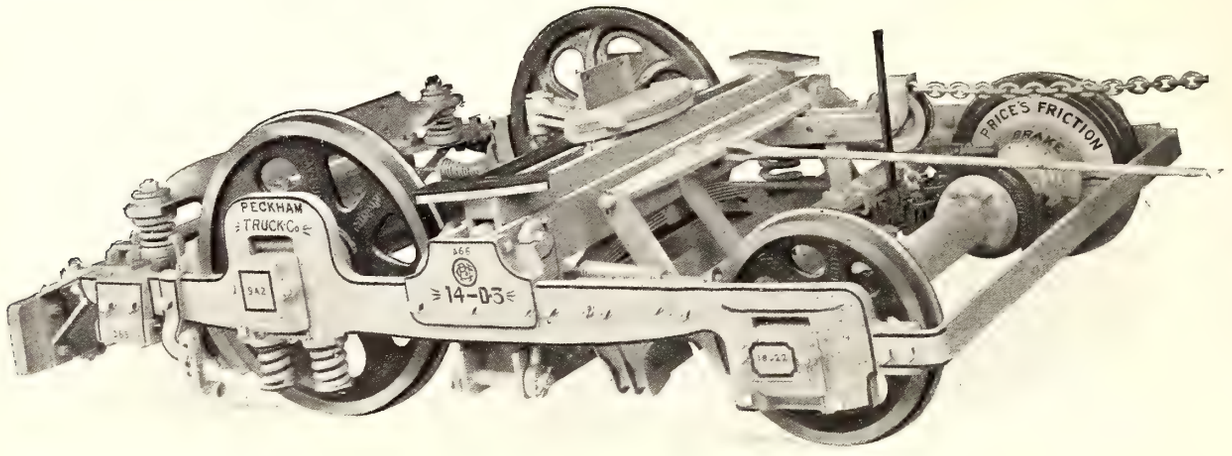


FIG. 3.—GENERAL VIEW OF BRAKE ON MAXIMUM TRACTION TRUCK

operating expenses that fall upon those systems of brakes that are driven by a current taken from the main current, either directly or indirectly.

And, finally, it is extremely rapid in application. It has been proved, by repeated tests, that the brake can be fully applied within one-quarter of a second from the time that the motorman starts to move the brake handle. With these advantages in its favor the mechanism is proving itself to be thoroughly efficient and reliable for the work that it is intended to do.

To adapt it to different styles of cars and service, this brake is constructed of three different styles—styles A, B and C. Style A is designed for use on maximum traction trucks, which use only one motor per truck. Style B is designed for single-truck cars, where the motors are attached to both axles. Style C is designed for double trucks, used for heavy, high-speed service. Among the roads which have used these brakes for several months are the Brooklyn Heights Railroad Company, of Brooklyn, which has forty equipments on maximum traction trucks, and the New Jersey & Hudson River Railway & Ferry Company, of Bergen County, N. J., which is operating ten 45-ft., fourteen-bench open cars, mounted upon Peckham 14-B 3 short wheel-base trucks, and equipped with four G. E. 57 motors. The grades of this road run from 6 per cent to 10½ per cent, with sharp curves. People's Tramway Company, of Putnam, Conn., is also using this brake, operating six cars, mounted upon Peckham 14-B 6 trucks, equipped with two Westinghouse 49 motors; as is also the Meriden, Southington & Compounce Railroad Company, of Meriden, Conn., which has four cars, mounted upon Peckham 14-B 6 trucks, with four Westinghouse 49 motors.

A Self Recording Cash Register

Street railway managers always welcome a device that tends to do away with or lessen clerical labor or lessen the liability of error in clerical work. For this reason the new self-recording register, herewith illustrated, which is being put out for the first time, should meet with success. This register does not depend on the accuracy of clerks or conductors in noting register readings, but furnishes printed slips to both conductor and company with the register reading thereon. At the end of his run each conductor may draw from the register a slip showing the register totals at the end of each trip during his run. On another slip, drawn from a long roll of paper in the register, is printed a duplicate of the conductor's record, this duplicate being under padlock, and accessible only to the company. As the register totals at the end of each trip are printed in plain figures, there can be no dispute between conductors and clerks as to register readings.

The operation of the register will be understood by reference to the accompanying engraving, together with the following. The number of fares and transfers rung up on a trip is shown by the numerals at the left. These numerals are claimed to be the largest in use on any register, and are 1¼ ins. high and 1 in. wide. The cash fares and transfers are, however, separate on the totalized records furnished on the printed slips. The direction of the trip is indicated at the right, and the kind of fare rung up shown in the center, the target showing kind of fare last recorded. The cord running to the right rings cash fares and sounds a loud bell, while that running to the left rings transfers and sounds a muffled bell. At the end of each trip the conductor turns the key on the right-hand under-side of the case, which automatically brings the register back to zero. In so doing he works a cam, which prints the totalized cash fare and transfer readings on the slips, by the impression of steel type on the paper. The company paper roll is of rather thin paper, and the impression of the steel type letters prints partly through the company paper and into the conductor slip, which is of thicker and softer paper. No fares can be rung unless the trip changing and printing key has been turned a full turn, and until the conductor inserts his strip. The conductor puts in and takes out his strips through a door in the side of the case, but this door does not give him access to the company paper, which latter can only be taken out by the door which is locked with the padlock. There is sufficient paper on the company roll inside the register to last one

NEW RECORDING REGISTER

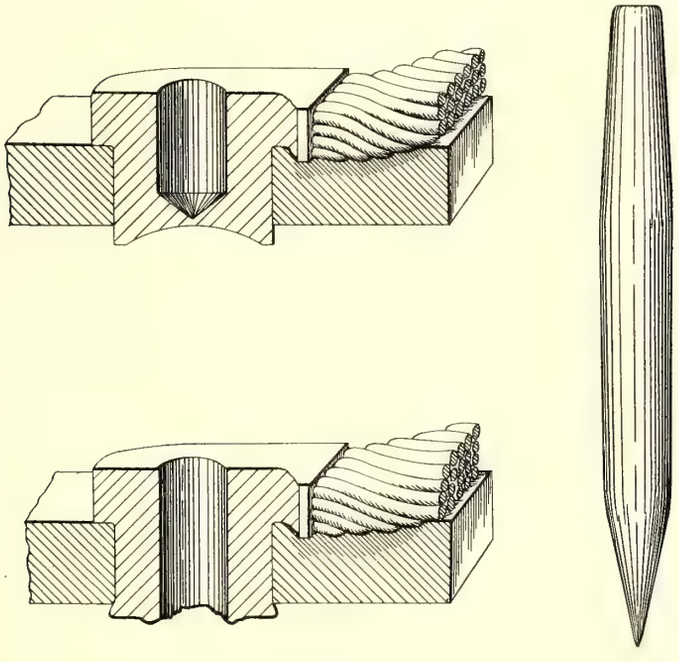
hundred days with proper handling. It is claimed that it takes less time to take out a conductor's strip or a company's strip than it does to note down a register reading in the usual way. As to the disposition to be made of the company and conductor strips there are a variety of plans open. The conductor may keep his slip as a check, for his own protection, or he may turn it in to the company. In any case, the register furnishes two positive printed records of every trip made, and that alone is enough to commend it, whatever the particular disposition of the records decided on. The mechanical parts are all made of steel, and are entirely interchangeable. The description above applies to the register recording two classes of fares, or double register. The single type records only one class of fares, but is operated with the conductor's strip and company paper, as in the double register.

The self-recording register will be on exhibition at the October convention. It is made by the St. Louis Register Company, and will be shown at the convention with the exhibit of that company.

An Improved Method of Attaching Rail Bonds

The accompanying illustrations show a rail bond which has recently been put on the market, and which is not only easily applied to the track but is very efficient. The application of the bond to the track is well shown in the cuts. A hole is punched through the web of the rail in the ordinary manner, and the cylinder-shaped projection on the terminal of the bond is placed in the hole. A hardened steel punch, shown on the right, is then driven through the thin copper web in the bond end by means of an ordinary heavy hammer. This punch, as will be noticed, tapers slightly to a little more than one-half its length, and after the sharpened end has broken through the solid copper, the tapering sides force the sides of the projection on the bond closely into contact with the iron of the rail. A cold riveted joint is thus produced, the peculiar shape of the bond head causing it to lap over the end of the hole in the rail web, thus locking it permanently in position.

It is evident that the bond cannot be left when improperly



SECTIONS OF BONDS AND PUNCH

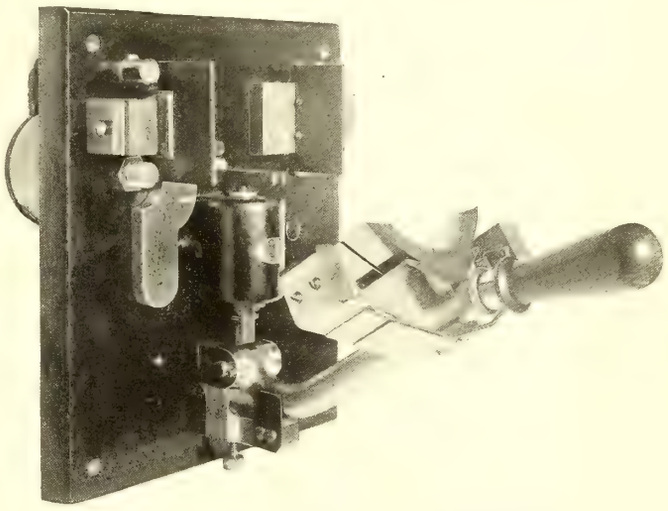
applied or only half riveted, as the steel pin, not being a part of the bond proper, must be forced entirely through before the workmen can go to the next bond, or the fish-plate attached. The bond is made in several forms, the ordinary flattened cable connection being shown in the illustration. It is the invention of Robert E. Benning, chief engineer of the Union Railway Company, New York, and is manufactured and sold by the Morris Electric Company, of New York.

Magnetic Blow-Out Circuit-Breakers

The Cutler-Hammer Manufacturing Company, well known as manufacturers of rheostats and electric motor controlling devices, will exhibit for the first time, at the Kansas City Street Railway Convention, a line of magnetic blow-out circuit-breakers, which possess several features of value in railway work. The accompanying cut gives a good idea of its construction and appearance.

The main contacts of these breakers are made of multiple leaf copper strips, pressing firmly against brass or copper surfaces, parallel to the plane of the switchboard. The arcing is taken from very heavy carbon blocks, which are easily renewable, and the opening of the breaker is sufficiently great to break the arc. In addition to this long break, however, two powerful magnets are used to blow out the arc, which they do so effectively that the breakers are guaranteed to open the circuit at their rated capacity 500 times without requiring repairs.

The pressure of the carbons and copper leaves is utilized to open the breaker, thereby eliminating extra push-off springs, which



MAGNETIC BLOW-OUT CIRCUIT-BREAKERS

would require extra manual exertion to close the breaker. This heavy pressure on the carbons also insures such a good contact that absolutely no arcing occurs at the copper brushes when they break contact. The blow-out magnets make a sharp, clean break of the arc, thereby eliminating the sheet of flame which occurs on breakers not provided with the blow-out feature, which flame is liable to injure both the breaker and surrounding instruments. The breakers are held closed by a hair trigger, which cannot be jarred loose, but will open with a very light blow, struck by the plunger of the tripping coil.

A feature of special interest is the time limit attachment, which allows the breaker to remain closed during the flow of an abnormal current which lasts but a few seconds, but will open the circuit if this abnormal current lasts long enough to endanger the apparatus. The breaker will open instantly, however, on short-circuits or dangerously abnormal currents. This result is accomplished by shunting a portion of the current around the tripping coil through strips of iron ribbon, whose cross section is so small that they are heated by the current. As these strips heat up their resistance increases, and more current is consequently sent through the tripping coil, eventually causing this coil to trip the breaker. It will thus be seen that abnormal currents that last but a few seconds will not have sufficient time to heat up the iron strips, but dangerously abnormal currents will shunt enough current through the tripping coil to cause it to act immediately without waiting for the iron strips to heat.

A very large range of adjustment of the breaker is obtained both by varying the lift of the plunger and the number of iron shunt strips, which are made easily renewable. The breaker can also be adjusted so as to make it sensitive or sluggish to moderate overloads, as may be desired. These breakers will be known to the trade by the letters W. T. L., which are the initials of the words "with time limit."

Motors for the Metropolitan Underground, Paris

The newly inaugurated Metropolitan Underground Railway system of Paris is probably the most notable instance of the application of the electric motor to high-speed underground railway service that has thus far been developed. This railway extends underground from Porte Maillot to the Porte de Vincennes, and 14 miles of track are in operation; but the route that is now open is only a small fraction of the projected Metropolitan system. When this enormous undertaking is finished its electric trains will reach practically every corner of Paris and its immediate suburbs.

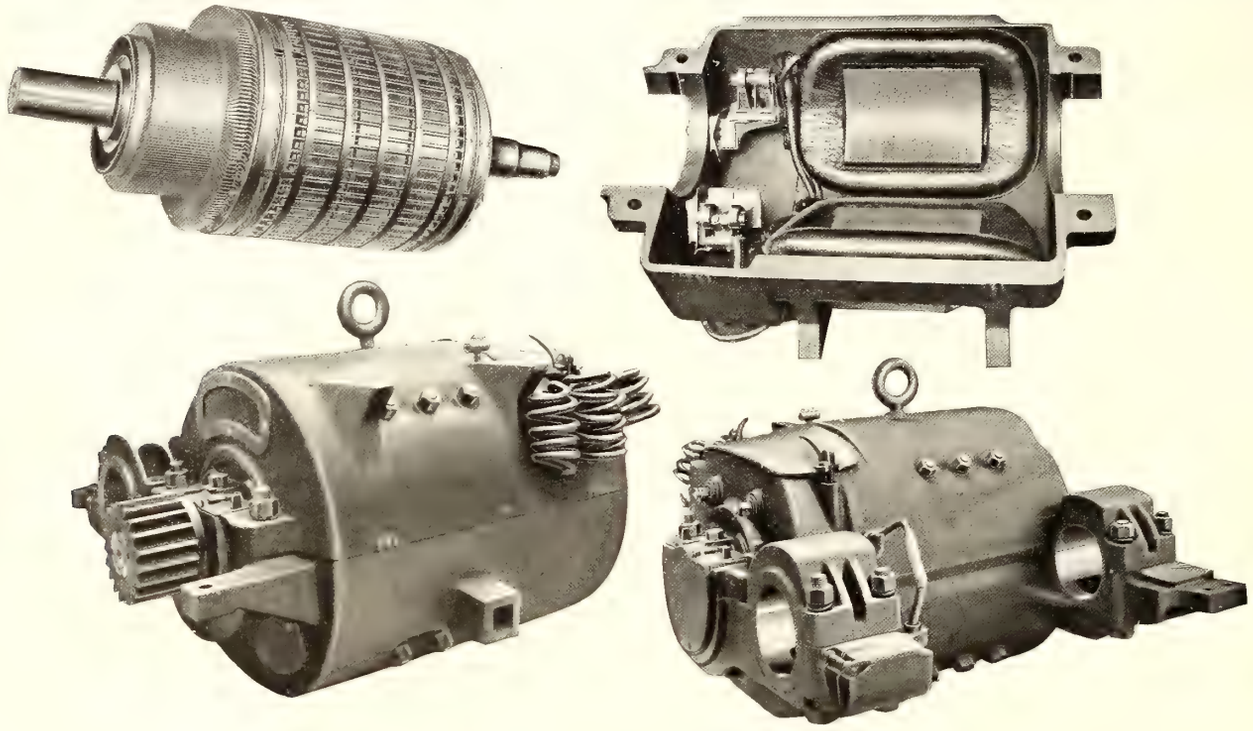
It would be difficult to find a greater contrast in transportation methods than that afforded between the present electric system and the ordinary street railway service of the French capital. Americans traveling abroad have been amazed at the inadequacy of the Parisian transportation systems, and the tiresome officialism associated with it. The omnibuses and street cars, as a rule, stop only at officially designated "stations," at each of which the waiting passengers are supplied with tickets, numbered in the order in which they were purchased. Upon the arrival of a particular omnibus the tickets that have been sold are called out in order, and only those passengers are allowed upon the bus whose tickets come first in order—provided, of course, the omnibus is not large enough for the entire number. This fits in nicely with the French idea of equality, but it has always proved very tiresome to American tourists.

The Metropolitan Underground has brought the first real relief to this condition of things. In October, 1898, seventy Westinghouse motors were ordered from the Societe Industrielle d'Electricite, Procedes Westinghouse for the new road. These motors are of the type designated by the makers as the Westinghouse No. 70, which are in regular service on some of the most prominent street railways of the United States, excepting, of course, that the motors for Paris were slightly modified to conform to the special designs of car and truck which are used in France.

There are presented herewith a number of illustrations showing the general appearance of this motor. It has a cast-steel frame, into which the pole pieces are bolted, the latter pieces carrying projections which keep the field coils in place. The frame is divided horizontally in such a way that the top half may be lifted off for inspection, or the under half similarly removed. It is adapted to the familiar side-bar suspension, and is equipped with a single train of gears, the gear ratio being 1 to 2.4. The motors have been guaranteed to give their full output for one hour of continuous running without excessive heating, and furthermore they are guaranteed to carry 50 per cent overload for twenty minutes, and 75 per cent overload for shorter periods.

The specifications of the Metropolitan Company were very exacting, and the motors represent the very highest possible practice in electrical construction. Each Westinghouse car equipment for the Paris underground includes two complete motors with gears, gear casings and suspension springs; two controllers, automatic safety circuit-breakers, safety fuse blocks and lightning arresters; also contact shoes, a complete car wiring for light and power, and electric couplers for supplying current to the trailer cars.

The armatures are of the slotted drum type with two-circuit windings. The core is of sheet steel of the highest magnetic quality. The armature is wound with copper bars, nearly rectangular in section, forged into shape without joints. Ventilation of the armature is adequate to stand very heavy overloads, and the motor frame is designed in such a way as to allow ample circulation of air through the motor windings, the openings for this purpose being provided with lids which may be closed when necessary.



WESTINGHOUSE NO. 70 MOTOR

The field coils are wound on curved molds, fitted to the shape of the motor. The best quality of copper wire, double cotton covered, and of round cross section, is used. The several layers of wire are insulated with mica and fibrous material, all being covered in with strong tape and treated with moisture-proof compound. All the coils are subjected to an insulation test at 3000 volts, alternating current.

The motors themselves were tested very thoroughly as to running qualities, the method being to couple the motors together; one, running as a motor, driving the other as a generator. In this way the motors were run for a period of one hour at a small overload, the direction of rotation being changed every twenty minutes. The insulation of the motor as a whole was furthermore tested at 3000 volts, alternating current. Insulation between two adjacent segments of the commutator was tested to 500 volts.

The motors were constructed by the French Westinghouse Company, and were guaranteed to give the train an acceleration of 3 ft. per second when starting from rest upon the level, and to maintain a speed of 22 miles per hour, assuming a 32-ton train, and sufficient weight on the driving wheels to secure the necessary adhesion.

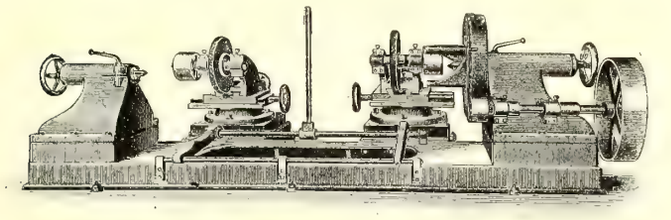
Trains on the Metropolitan underground consist of one motor car, equipped with two motors, and drawing one or more trailers. The motor car is double-ended, having a motorman's compartment at each end, in which is placed a series-parallel controller. The train is also equipped with air brakes, operated by an electric air compressor.

On the present line there are eighteen stations, the average distance being about 700 yards. The average speed of the trains is 15 miles an hour, including stops. The average length of the stop is approximately twenty seconds, and the run between termini, a distance of about 7 miles, is, therefore, made in about half an hour. Thus far, a ten-minute service has been employed, but the control of the electrical equipment is so complete that the intervals between trains may be as short as desired.

Electric Car Wheel Grinder

The car wheel grinder, illustrated herewith, is intended for use in railway repair shops, where efficient and rapid work is required. The machine is equipped with 18-in. x 1½-in. emery wheels. The head and tail stocks and emery wheel heads are on one solid base, which prevents vibration and secures accurate work. The emery wheel head is practically upon a compound slide rest, which is on a swivel head admitting of any desired angle. The machines are so arranged that one operator can grind two wheels at a time.

The spindles are ground and lapped and run in bronze boxes,



CAR WHEEL GRINDER

with dust-proof collars, and are arranged to take up the wear. There is a short track attached to a lever and a cam; the wheels are run upon this track, and by bringing the lever down the track is lifted and the wheels brought to center, making a simple device for centering the wheels before grinding. The head and tail stock spindles are arranged to give a variation of 8 ins. between centers and the machine is arranged for either extremely wide or narrow gage, as desired.

This improved car wheel grinder is made by the Springfield Manufacturing Company, Bridgeport, Conn.

Water-Wheel Governors

The whole subject of governing water-wheels is so obscure and of such a difficult nature that it is almost impossible for the ordinary engineer or operator of a water power to predetermine what degree of speed regulation can be obtained, how the governor should be connected up, or what changes in the plant, if any, will be necessary to obtain the best results. He is, therefore, more or less at the mercy of the manufacturer, and it becomes more advisable than in any other department of hydraulic engineering to choose a reliable house.

The Lombard Water-Wheel Governing Company, Boston, Mass., is having decided success with its apparatus, and has a force of consulting engineers, who are constantly employed on just such problems. The company manufactures governors for all makes of turbines and impulse wheels on practical, novel designs, which are broadly covered by letters patent. They are simple in operation, regulate closely, and are in successful operation in many water power plants throughout the country.

The chief engineer of the company, Allan V. Garratt, is well known in engineering circles, and especially in connection with the development of hydraulic installations. The work of the company is under his careful superintendence, and its excellence is thus assured.

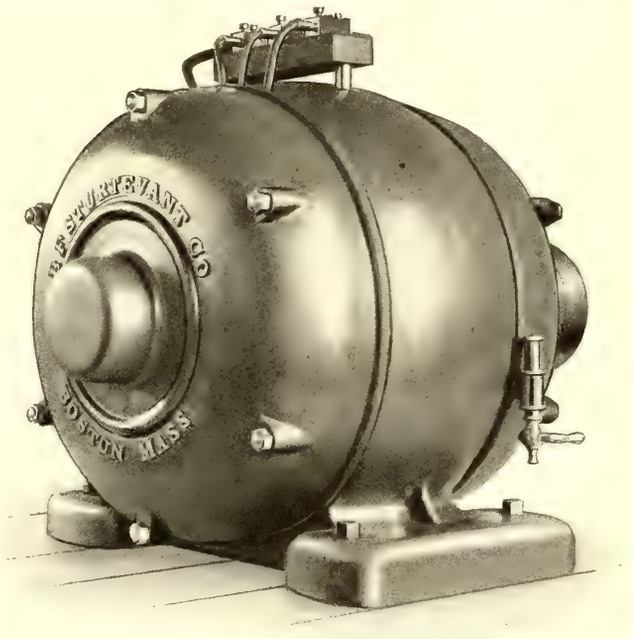
A New Type of Enclosed Electric Motor

This type of motor, built by the B. F. Sturtevant Company, Boston, Mass., being inclosed and readily portable, in the small and medium sizes, is specially adapted for driving small machines, such as machine tools, blowers, etc. For certain classes of work, where the conditions are favorable, the motor may be direct-connected to the machine which is to be driven. Cased fans of the centrifugal type may be thus equipped, and if desired the fan casing itself may be supported by the motor frame and made adjustable about it, so that any direction of the air discharged may be provided.

In order to avoid the excessive temperature which is incident to the operation of most inclosed motors, this type has been very carefully designed, so that a low temperature rise can be maintained without greatly increasing the size and weight above that of the ordinary open type.

This machine is capable of continuous operation for ten hours, with a maximum temperature rise not exceeding 60 degs. F. Yokes extending out from the field ring support the armature shaft. The end casings are entirely independent and can be instantly removed to give access to the entire interior. The bearings and brushes can be reached by simply removing the caps in the center of the casings.

The brushes are of hard carbon, in holders of a modified reaction type, which allows of easy adjustment when it becomes neces-



ENCLOSED ELECTRIC MOTOR

sary to reverse the direction of rotation of the motor. The bearings are self-oiling and self-aligning, and fitted with composition sleeves, which are removable from the outer ends of the boxes. These motors are built in this type in seven sizes, ranging from 1-6 hp to 5 hp.

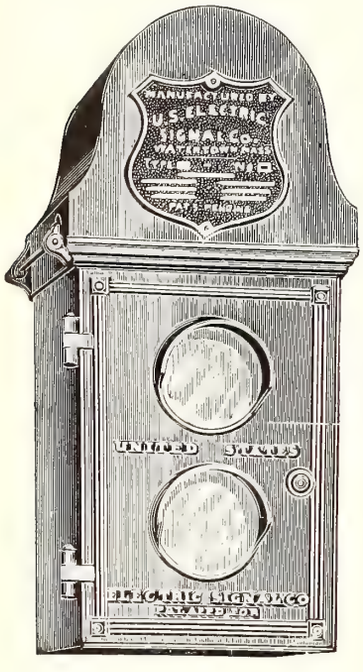
Manager for an Air Brake Company

Anthony H. Metzelaar has lately resigned his position with the Magann Air Brake Company, Detroit, Mich., with which company he has been for the last two years, to assume the position of general manager for the Knell Air Brake Company, Battle Creek, Mich. Mr. Metzelaar is a graduate of the Engineering College of the city of Amsterdam and took one year's post-graduate work at the Michigan Agricultural College, Lansing, Mich. He has made a special study of compressed-air apparatus and begins his new work with the best wishes of his friends.

Dick, Kerr & Company has commenced work on the construction of 20 miles of permanent way for the Gateshead (England) Electric Tramways for the British Electric Traction Company, and the same company has just completed its contracts for the construction of the permanent way for the British Electric Traction Company for its extensive system in the Potteries District. This is by long odds the most important interurban tramway system so far undertaken in Great Britain, connecting as it does a series of towns of considerable population lying close together throughout the working districts of the Midlands.

A New Automatic Block Signal for Electric Railways

This signal is designed especially for use on single track trolley roads, to show positively whether the section to the next turnout is free, or whether occupied by another car. The signals are operated by the trolley wheel of the car coming in contact with an automatic switch placed on the trolley wire. The signal proper consists of a signal box, usually placed a short distance beyond a turnout, and made of a substantial cast-iron case containing the mechanism. In the front of the signal box are placed two windows, one covered by a red glass and the other by a green or white glass, and behind each of these windows are two incandescent lamps. The boxes are always used in pairs, and are electrically connected by two wires. In each box are two operating magnets, the power developed being five or six times as great as required, giving a large margin of safety. When a car enters the block section, one set of signals is operated, showing a white or green light at the entering point, and a red light at the other end of the section. The armature of the lighting magnet is mechanically locked in place after it has operated the proper contact, and if the lamps are extinguished through failure of the current, they will immediately be relighted when the current returns. They can thus be permanently extinguished only by the action of the putting-out magnet, which cannot be operated until the car has reached the further end of the section. In the same manner, when a signal is set for either direction, a signal for the opposite direction is mechanically locked out of service. The lamps in the two signal boxes being in series, one signal cannot be set without the other being set, and the motorman entering the block and seeing the green or white light, knows the red or danger signal at the other end is lighted.



CASE OF SIGNAL

This ingenious system is the invention of J. J. Ruddick, and is manufactured by the United States Electric Signal Company, of Watertown, Mass. For nearly two years the members of this company have been developing and completing it, and have produced a system which is not only simple and reliable, but which can be applied with but small expense to existing roads.

An Interesting Wire Exhibit at Paris

John A. Roebling's Sons Company had a most interesting exhibit at the Paris Exposition. It was practically two exhibits, as it was divided into two entirely distinct sections, each of which received an award of a grand prize. One of these was a general collection of samples, specimens and models of wires, cables, etc., and contained many results of the company's capabilities. The other was of more interest to street railway men, however, as it represented the electrical department of the Roebling Company. The principal feature of this section consisted of a full-sized model of a section of underground trolley track, illustrating the arrangement of the feeders, ducts, etc. Besides this main attraction there were innumerable examples of the Roebling wire which is manufactured especially for electrical uses.

A Well-Tested Cash Register

The New Haven Car Register Company, of New Haven, Conn., will make a full exhibit at the Kansas City Convention of the various styles of its widely known single, double and triple-fare registers, both round and square. The company has been doing a very large business during the present year, and has added a large number of roads to its already long list of customers among the leading roads of both this and foreign countries. It will place on exhibition one of its machines, which has a record of upward of 10,000,000 registrations, made in actual use on rapidly moving machinery in a large wood working factory. The register has withstood the test, which is equivalent to over one hundred years constant use on street railways, in a remarkable manner, it being still unimpaired for regular service. This machine will undoubtedly attract much attention at the convention, and will certainly be taken as conclusive evidence of the good wearing qualities of these registers.

AMONG THE MANUFACTURERS

BABCOCK & WILCOX BOILERS have been awarded the grand prix at the Paris International Exposition of 1900.

THE SNOW PLOW BUSINESS is again commencing. Arthur W. Field, Boston, reports a number of sales of rotary snow plows in New England this fall.

THE AMERICAN BRIDGE COMPANY announces that August Ziesing has been appointed general Western representative of the company, with headquarters at Chicago, Ill.

THE UNITED STATES ELECTRIC COMPANY, of Watertown, Mass., has recently purchased the Bancroft & Sullivan patents, consisting of United States and foreign patents for electric street railway block signalling.

THE LITOFUGE MANUFACTURING COMPANY, formerly at 1710 Market Street, Philadelphia, Pa., has removed to 2240 and 2242 North Ninth Street, where it has secured larger and more commodious quarters.

GEORGE A. PARMENTER, Cambridgeport, Mass., manufacturer of the well known Parmenter fender and wheel-guard, reports some very good orders lately. The most important of these is one embracing all the street cars of Havana, Cuba.

A MEDAL FOR THE BRISTOL COMPANY.—The jury of award at the Paris Exposition has granted the Bristol Company, of Waterbury, Conn., a silver medal for its exhibit of recording electrical instruments, and has also given honorary mention to its recording steam and pressure gages.

THE BURT MANUFACTURING COMPANY, Akron, Ohio, maker of the Cross oil filters, has recently commenced to advertise the Burt exhaust head. Mr. Warden, manager of the company, reports that orders are crowding in in a most satisfactory manner, and a busy season is expected.

EDWARD P. SHARP has been appointed manager of the street railway department of the Bierbaum & Mervick Metal Company, Buffalo, N. Y., exclusive manufacturers of Lumen bronze for bearings, and also of the Ideal trolley wheel, two high-class specialties that Mr. Sharp firmly believes will make many new friends for him.

THE JEFFREY MANUFACTURING COMPANY, Columbus, Ohio, was awarded a gold medal at the Paris Exposition covering its line of elevating, conveying and mining machinery. The company's new and complete catalogue describing its extensive line of chains, etc., is now ready for distribution, and will be gladly sent to all who ask for it.

THE EUREKA TEMPERED COPPER WORKS recently booked one of the largest orders for drop forged commutator bars ever placed in this country. The company is naturally greatly pleased at this recognition of the superior quality of its goods, and in the future will attempt to maintain the high standard attained by its drop-forged segments.

AN INTERESTING FEATURE OF THE PARIS EXPOSITION, especially to electrical men, was the exhibit of electrical measuring instruments made by James White, Glasgow, Scotland. The many persons who admired this exhibit, as well as the numerous friends of the concern, will be glad to learn that it was awarded the grand prix.

THE AULTMAN COMPANY, CANTON, OHIO, has arranged with the C. T. Patterson Company, Ltd., of New Orleans, to represent it in the sale of its complete line of elevating conveying and power transmission machinery. A competent force of engineers is at hand to give prompt and intelligent attention to all inquiries received for this class of machinery.

"LIGHT ON THE JOINT QUESTION."—A little book has been issued with this title, by the American Improved Rail-Joint Company, Chicago, giving the recent decision in the United States Court of Appeals on the subject of cast-welded rail-joints. Since the decision is necessarily of interest to all users of this type of joints, the pamphlet will probably be widely read.

THE ELECTRICAL POWER STORAGE COMPANY, LTD., of London, has been awarded a gold medal at the Paris Exposition, which has been granted to it chiefly on account of its new Faure-King model for auto-car work. H. W. Butler, chief engineer of the company, was, in addition, personally awarded a silver medal for the general excellence of the company's manufactures.

H. W. JOHNS MANUFACTURING COMPANY, New York city, recently secured a contract from the Pittsburgh Plate Glass Company, Ford City, Pa., for furnishing and applying asbestos fire felt covering for its factory No. 3, in which plant the Pittsburgh company is now installing twelve new boilers and the necessary steam pipes. The contract in question will amount to over $2,000.

THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED, London, has recently opened a branch office in Manchester, in the Trevelyan

Building, Corporation Street, where local inquiries will receive every attention. To meet the increasing business of the company in the Northern Provinces, it has, in addition to the other branch offices, opened a branch at Newcastle-on-Tyne.

LARGE CONTRACT FOR THE AMERICAN BRIDGE COMPANY.—The new ship-building plant for the Risdon Iron Works, at San Francisco, Cal., will be built by the American Bridge Company, of New York, and will consist of a boiler shop, machine shop and foundry, all of the latest design and most modern description.

THE STANDARD AIR BRAKE COMPANY, New York, is being kept busy by the large number of duplicate orders and new business that it is getting. This company has been particularly successful with its axle-geared compressor, which is run without the use of an auxiliary motor. The good points of this device are rapidly pushing it into favor with the managers of railways throughout the country.

"GROOVED TROLLEY WIRE" is the subject of Bulletin No. 4228, of the General Electric Company. The ears used to hold this wire have the form of longitudinal clamps, which are tightened by transverse screws. The wire is made in three sizes, equivalent to No. 00, No. 000 and No. 0000 round wire, the actual diameter of the grooved wire being sufficiently great to allow for the metal taken out by the grooves.

THE FRANK RIDLON COMPANY, OF BOSTON, which is the New England agent for the Mayer & England Company, of Philadelphia, and which represents the Protected Rail Bond Company in the East, has obtained the entire rail bonding for the elevated work in Boston, including both wheel rail and third rail. This is one of the largest and most exacting rail-bonding orders that has ever been placed.

PHOSPHOR BRONZE in many forms is described in a little pamphlet issued by the Phosphor Bronze Smelting Company, Ltd., Philadelphia. The company is one of the original manufacturers of this material, and is the sole maker of the well known "Elephant" brand. Besides being a catalogue and price list the book contains much valuable and interesting information regarding phosphor bronze and other alloys, as well as numerous useful tables.

A MAMMOTH CATALOGUE.—The General Electric Company, Limited, of London, England, has distributed what is probably the most comprehensive list of electrical apparatus and supplies ever placed before the public. The volume is handsomely bound, and contains 1000 pages of closely printed matter. It is divided into sections, and covers dynamos, motors, wiremen's sundries, fixtures, heating, telephone bells, electro-medical supplies, etc.

AN UNEXPECTED PARIS AWARD.—The Triumph Electric Company, Cincinnati, Ohio, reports the receipt by it of a medal from the Paris Exposition for the excellence of its machines. The company is especially gratified at this recognition of its product, as it was not a regular exhibitor, but had merely loaned its apparatus to other companies for the purpose of operating their exhibits. The award, therefore, came as a great surprise to the Triumph Company.

GENERAL ELECTRIC LINE MATERIAL is described in catalogue and price list No. 7530. In the pamphlet will be found everything in the way of materials for overhead construction, such as insulators, strain and bracket suspensions, curve suspensions, plain trolley ears, clamping ears, splicing sleeves, crossings, etc. So many articles are mentioned that without the index, which concludes the book, one would have difficulty in finding any particular thing desired.

A. O. SCHOONMAKER, New York, importer of mica for electrical and other purposes, is having a large trade in India and amber mica, both cut and uncut. A specialty is made, however, of stamped solid sheet segments and washers. The uncut sheet, or block, mica is always carefully selected as to size, so that as little waste as possible will result when articles are being manufactured from it. Among the numerous lines carried may be mentioned mica plate, flexible mica, mica cloth, mica paper and mica tubing.

THE LEONHARDT WAGON MANUFACTURING COMPANY, Baltimore, Md., reports that 1900 has been one of its busiest years. The company has put out more of its easily operated, revolving tower wagons than ever before. These wagons are built with large and roomy tool compartments, and can be raised and lowered by one man. Their operation has been so satisfactory to the users that much of the business done by the Leonhardt Company has been the filling of duplicate orders.

ARTHUR KOPPEL, Berlin, Germany, has issued a large volume containing a collection of views taken at installations of industrial railways put in by this firm in all parts of the world. The descriptive text is written in six languages, which shows the wide distribution expected to be made of the publication. The cover is highly illuminated, and shows a scene in a forge, while the illustrations within give a comprehensive idea of the widespread adaptation of the narrow-gage railway to manufacturing and other industrial purposes.

THE BRITISH SCHUCKERT ELECTRIC COMPANY, LTD., of London, England, states that the Schuckert Company was represented at the Paris Exposition in the four following sections: Section 23, electrical machinery and motors; Section 25, electric lighting plant; Section 29, general plant; Section 118, electrical apparatus for marine and naval purposes. In all four cases the grand prix has been awarded. The engineers and representatives of the firm have also received nine gold medals and eight silver and bronze medals.

THE CRANE COMPANY, New York, is distributing a handsome metal sign which will undoubtedly prove sufficiently handsome to commend a share of the wall space of many engineering offices. The sign is over a foot long and is decorated in colors. The design represents an 18-in., extra heavy, iron body gate valve, with outside screw and yoke and by-pass. Numerous gates of this style have been installed, it having been extensively used in the equipment of power plants. A representation of wrought-iron pipe makes an effective border.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY.—In a recent communication to this firm, the George A. Fuller Company, contractor for the Broadway Chambers Building, New York City, a model of which is exhibited at the Paris Exposition, states: "Your dynamo forms a prominent feature in our exhibit, and helped to obtain the grand prize and gold medals which have been awarded to this exhibit." Prospective purchasers would serve their own interests by investigating the Bullock dynamos and motors before placing their orders.

THE H. W. JOHNS MANUFACTURING COMPANY, of New York, has secured a contract for supplying and applying asbestos fire felt covering for the steam pipes, boilers and brine pipes at the Havana Brewery, Havana, Cuba. The company is sending skilled labor from New York to carry out this contract, and it is the first instance of this kind that is on record. There are a number of new power plants being constructed in Havana, and the Johns Manufacturing Company believes in being on the field with its skilled labor and materials to insure getting the work.

THE MEYERCORD COMPANY, Chicago, has made such a good showing at the Paris Exposition that it has received the highest and only award given in the company's department. The decalcomania transfers which were placed in competition with the foreign manufacturers attracted much attention, and many thousand dollars' worth of business was placed abroad. To attend to this business and keep it active, a large number of permanent agencies have been established in Europe. One of the company's specialties which elicited much praise was its new opalescent window signs.

AUTOMATIC LUBRICATION.—The Siegrist Lubricator Company, St. Louis, Mo., has received a duplicate order from the Imperial Electric Light, Heat & Power Company, of the same city, for the Siegrist automatic oiling system, to be used in connection with some new units now being installed in the Imperial Company's plant. The Siegrist system has been under practical test in the Imperial plant for the past year, and the fact that the Imperial Company has given a duplicate order is evidence that the system has given satisfaction. A description of this system is given in the reading columns of this issue.

WESTERN ELECTRIC SUPPLY COMPANY, St. Louis, Mo.—In a supplement to its catalogue No. 22, this company describes the G. I. circuit breakers. These circuit breakers are made largely for railway use, and their fine finish and simplicity give a handsome appearance to the switchboard, as well as insuring efficient operation. They are easily closed and quick to open, roller latches of hardened steel being used to give a frictionless design. The laminated contacts are well made and protected from arcing. The Paragon bipolar power motors are also described in this supplement, as well as starting boxes for the same.

TRIUMPH MOTORS.—The Triumph Electric Company, of Cincinnati, Ohio, has received the following from C. P. Alterberg, manager of the foreign department of the J. A. Fay-Egan Company, Paris Exposition: "We have used five of your 220-volt motors, aggregating 100 hp, to operate our exhibits at the Paris Exposition. Up to date we have not expended 1 cent in repairs of any kind; our operators give the motors no attention beyond keeping them clean and the bearings supplied with oil. I feel highly gratified with their performance, and take pleasure in so advising you." As the communication came entirely unsolicited, the Triumph Company is naturally highly gratified at its receipt.

EFFICIENT TUBE CLEANERS.—The Lagonda Manufacturing Company, of Springfield, Ohio, recently sent one of its "water power turbine cleaners" to the Warren Water Company. C. E. Inman, superintendent of the company, writes that after cleaning one boiler and part of another, he is more than pleased with the machine. He states that it has removed scale that was really a surprise to him, as he did not suppose it would be possible for such a machine to remove scale as thick and hard as found in their boilers. It is such a curiosity that he has several pieces which he keeps for exhibition. This is only one of numerous reports of this kind that the Lagonda Company is constantly getting from users of its machines.

THE BETHLEHEM STEEL COMPANY reports that among the orders recently booked are spare propeller shafts for the steamers "Ponce" and "San Juan," of the New York & Porto Rico Line, which are being furnished to Harlan & Hollingsworth Company, of Wilmington, Del. The company is also supplying eight forged hollow shafts of fluid-compressed, open-hearth steel, for use in Cuban sugar mills, and, in addition to these, it is making a large number of gun barrels for the Winchester Repeating Arms Company and Colt's Patent Fire Arms Company. These latter forgings are to be made of Bethlehem nickel steel, which is peculiarly adapted to the purpose on account of its ability to withstand severe strains.

THE WEINLAND TUBE CLEANERS.—The Lagonda Manufacturing Company, Springfield, Ohio, is having great success with the Weinland Mechanical Tube Cleaners, which are being widely introduced. The operation of these tube cleaners is extremely simple, a belt being used to revolve the series of cleaner heads with cutter-wheels attached, which make up the cutting apparatus. This belt can be driven by steam, gas or gasoline engine, electric motor or any suitable power, so that the machines can be used under almost any conditions. This class of apparatus is peculiarly adapted for giving proof of its efficiency, and the Lagonda Company is constantly in receipt of testimonials telling of relief to boilers that were filled with scale.

THE MORRIS ELECTRIC COMPANY, of New York, has had a most successful summer and fall, and is looking forward to a much larger increase of business in the future. It has sold a great many rail bonds, 6000 having been included in a recent European order, and seven different roads are using electric heaters obtained through the company. Five complete cars have recently been built in the company's own shops for Mexico, and Costa Rica has received three carloads of iron poles, one carload of car wheels and 4000 rail bonds. Large shipments have been made to Cuba, including seventy-six carloads of Mason Potomac terra-cotta conduit, 1000 iron poles, 20 miles

of line material and trolley wire, as well as the complete installation of a 500-light incandescent electric plant. The European orders comprise 20,000 carbon brushes, among many other supplies and tools.

FLEXIBLE MICANITE PLATE, STYLE C, is the name of the latest addition to the line of high-grade insulators manufactured by the Mica Insulator Company, New York and Chicago. The company has been experimenting and working for many months to perfect this material, and believes it will prove one of the most important of the many original contributions it has made to the electrical industries. Flexible micanite plate, style C, will stand a high temperature without losing its mechanical strength. It will also remain flexible indefinitely, and can therefore be safely carried in stock. For all general insulating purposes, insulating transformers, armature and field magnet cores, armature slots and commutator shells, etc., it will be found of great value.

A LIST OF SALES OF MECHANICAL STOKERS has been issued by the Westinghouse Company. The list gives the names of some recent purchasers of the Roney mechanical stokers with the total boiler horse-power which will be installed when the present orders are completed. This, of course, represents a much larger engine horse-power, but it gives some idea of the number of large stations using the Roney stoker. Among the larger ones may be mentioned the Manhattan Railway Company, 34,000 hp; the Third Avenue Railroad Company, two stations, 36,000 hp, and the Metropolitan Street Railway Company, all of New York. Eight orders, aggregating 12,500 hp, from the United Railways & Electric Company, Baltimore, Md., are also recorded.

AGING OF TRANSFORMER IRON.—The General Electric Company is distributing a ninety-two page pamphlet on the subject of "Aging of Transformer Iron," containing five important articles that have been issued regarding this subject, as follows: "The Aging of Transformer Iron," by Prof. W. Elwell Goldsborough; "On Slow Changes in the Magnetic Permeability of Iron," by W. Mordey; "Effects of Prolonged Heating on the Magnetic Properties of Iron," by S. R. Roget, B. A.; "Hysteresis in Sheet Iron and Steel," by Arthur Hillyer Ford, and "The Aging of Transformer Iron and Steel," by J. A. Capp. This pamphlet is one that should be in the hands of every central station manager, and will be gladly furnished to all who apply for it to the General Electric Company.

DEOXIDIZED BABBITT METAL, as manufactured by the Bridgeport Deoxidized Bronze & Metal Company, can be easily distinguished from inferior metals by its silver-like appearance. It is clean and smooth, and contains no lead, so that it cannot "be used for a pencil." This fact is taken advantage of in getting out a novel little pamphlet, on the front page of which appears the surprising information that the recipient cannot write his name. The investigation of the "why?" which this naturally produces discloses the remainder of the statement on the last page, and shows that it is, when Deoxidized Babbitt Metal is employed, that the inability exists. The little book contains several testimonials in the form of facsimile reproductions of the original letters, which show that for other purposes the metal is most satisfactory.

THE LARGEST ELECTRICAL POWER PLANT IN THE WEST, that of Armour & Company, Chicago, is equipped with gate valves and other steam fittings made by Crane & Company, of that city. The piping system of this installation was carefully worked out in order to secure both mobility and simplicity. The main header connecting the twelve boilers with the engine-room is 172 ft. long and is fitted with Crane extra heavy cast-iron flanges and divided into three sections by two Crane high-pressure gate valves. The same style of valve is used on the boiler-leads to the main header and on the engine-leads. This installation serves as a good example of the kind of engineering work the Crane Company is doing. This branch of its business is becoming a very important one, 250 complete piping equipments being a conservative estimate of the work it has done during the last five years.

TRACK SANDING.—Whether shoveled onto the track by hand or allowed to pour out of the sand box in a stream the application of sand has long been a source of annoyance. Both methods have some advantages and many disadvantages. The Frank Ridlon Company, Boston, Mass., claims for a track-sanding apparatus which it is putting on the market all of the advantages and none of the disadvantages of the old methods. The device, which weighs but 18 lbs., takes the sand from the box in small scoopfuls, and deposits it in a tube, which transmits it to the track at exactly the right place. Any kind of sand may be used, the apparatus working equally well, whether it is fine or coarse, wet or dry. A depression of a button placed conveniently near the motorman's foot deposits but one portion of sand on the track, so that there is no wasteful flow or such an excess used as to render liable the production of flat wheels.

SOME LARGE ELECTRICAL CONTRACTS.—Kohler Brothers, contracting engineers, Chicago, Ill., report the following contracts on hand: Southside Alley L installation of 48,000 ft. of 1,500,000 circ. mils feeder wire, just completed; Southside Alley L, removing 29,000 ft. of feeder wire, now in progress; Chicago & Alton Railroad Company, complete equipment of power plant, Bloomington shops; Illinois Central Railroad Company, complete underground and overhead and interior construction for lighting right of way and suburban stations; *Chicago Tribune*, complete equipment of press-room with patented mechanical and electrical devices; Illinois Asylum for Feeble Minded Children, Lincoln, Ill., complete steam heating and lighting contract; Coliseum, entire lighting and switchboard contract; McCormick Harvesting Machine Works, Chicago, wiring foundry and installing trolley line.

A MOST INTERESTING AND HANDSOME SOUVENIR of the Paris Exposition has just been issued by Witting Brothers & Company, Limited, of London, who represent in England Electricité et Hydraulique, of Charleroi, Belgium. The souvenir consists of an album about 14 ins. long by 9 ins. wide, which contains a number of very beautiful photographs of the exhibition, in addition to a few particular photographs of their own exhibits. There are beautiful pictures of the Chateau d'Eau, the Trocadero, various views of the Seine in the vicinity of the Exposition, showing the Belgian government house in the Street of Nations, the new Alexander III Bridge, opera house, etc., which are neatly interspersed with views of the various exhibits of Electricité et Hydraulique, in which Witting Brothers are interested. There will doubteless be a great demand for this handsome souvenir, and we feel sure that every engineer ought to endeavor to procure one.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, Mo., will be represented at the Street Railway Convention by Charles Scudder, Jr., manager of its electric railway department. He will make his headquarters at the exhibit of the Ohio Brass Company in the Convention Hall, although he will also have a display and be glad to see electric railway men at the Baltimore Hotel. This company has gradually enlarged its electric railway department so that to-day it carries one of the largest stocks of electric railway supplies in the West, and is prepared to equip electric railways complete with anything pertaining to their construction, maintenance or operation. A catalogue devoted exclusively to electric railway supplies has recently been published, which is about the only one covering everything pertaining to electric railways from a bonding cap to a complete electric railway. The company will mail this catalogue on application.

IDEAL ENGINES FOR STREET RAILWAY SERVICE.—A. L. Ide & Sons, Springfield, Ill., are making a modified design of their Ideal four-ported engine especially intended for use in street railway power houses. Like all Ideal engines, its construction is reduced to the simplest forms available, and embodies the well known original self-oiling system. The liberal proportions of the working parts, the use of special material for each of such parts, and the constant flush of oil over all the bearing surfaces, are features which qualify the Ideal engine for continuous and severe service. The valves and valve-gearing, while producing results in efficient steam distribution approaching the performance of a Corliss valve equipment, are of the simplest form, and are capable of operating with the utmost smoothness and ease at any speeds up to the highest. Thus, a highly efficient engine devoid of all complicated mechanisms is offered, and will undoubtedly find favor among the managers of those roads where the kind of service for which the engine is built is required.

HEAT INSULATION ON OCEAN STEAMERS.—The P. & B. Giant Insulating Papers manufactured by the Standard Paint Company, whose main office is in New York, with factories in New Jersey and at Hamburg, Germany, have been used in the construction of the cold-storage rooms and the insulation of the freezing tanks of the "Deutschland," as well as on many of the other large ocean grayhounds and freight-carrying vessels. The list embraces the "St. Louis" and "St. Paul," of the American Line; "Kaiser Wilhelm der Grosse," "Friedrich der Grosse," "Barbarossa" and "Koenigen Luise," of the North German Lloyd; and the principal steamers of the Cunard Line, White Star Line, Red Star Line, Furness Line, Elder Dempster Line, and many others. The experience had with P. & B. insulation on the vessels mentioned has proved that this material gives most excellent results. The temperature in their cold-storage rooms is easily regulated on account of the efficient insulation obtained, and the manufacturers claim that no other material could give as great satisfaction.

WITTING BROTHERS & COMPANY, LIMITED, of London, England, have in hand one of the largest contracts that has ever been placed for polyphase motor-generators. The order in question has been placed with Witting Brothers by the Metropolitan Electric Supply Company, of London, and includes the supply and erection of six 500-kw polyphase motor-generators and three smaller sets for exciting, making a total of 9000 hp in electrical machinery. The motor-generators, which are of the synchronous type, will be placed in the Manchester Square station of the company, deriving current from the new Willesden station, distant about 3 miles. The Westinghouse generators in this station generate two-phase current at 500 volts per phase, which is raised to about 10,000 volts for the line; at Manchester Square this will be stepped down to 1000 volts per phase for the motor-generators. Each of the large motor-generators consists of a 900-hp synchronous two-phase motor coupled to a 500-kw generator, both machines being of Witting Brothers' standard pattern. Each machine has two bearings, and each bed-plate is provided with flanges and faced seatings for bolting together, the combination running at 212 r. p. m. at 60 cycles.

THE EMPLOYMENT OF HIGH-PRESSURE ALTERNATING CURRENTS has of late given a great impetus to the growth of electrical undertakings for the transmission of power over extended areas, and the consequent rapidity with which new designs of generators, motors, switchboards, etc., for this service had to be made, as well as the enormous amount of apparatus that has been supplied, has kept the manufacturers busy. The active development of this industry and the exceptional demands made on the different departments owing to the large increase of orders has prevented the firm of Brown, Boveri & Company, Ltd., Baden, Germany, from laying before those interested an account of its recent operations. In a report on the more important installations carried out during the last few years the company presents a pleasing description of many plants in which it has been interested, well illustrated by large engravings and bound in an attractive manner. Much interesting matter is devoted to general remarks about the Brown-Boveri apparatus, for both alternating and direct-current, but the larger part of the book is made up of a partial list of installations made during the eight years the company has been in existence. The list is arranged geographically, and a short, technical description of each plant is given. The copy which reached this office was written in English, but editions in German and French have probably been printed for use in other countries.

COCHRANE FEED-WATER HEATERS.—In every steam plant a properly designed exhaust steam feed-water heater will effect a saving, according to the conditions, of from 5 per cent to over 20 per cent. This will take place whether the plant is operated high pressure, exhausting free to the atmosphere; whether operated under back pressure, using the waste steam for heating or drying; or whether it is operated condensing. The saving

will be made even though these plants are equipped with economizers and provided with live steam purifiers; and while making it the exhaust steam feed-water heater will eliminate the strains caused by introducing cold water into boilers, economizers and live steam purifiers, which strains are chiefly recognizable in repair bills and stoppages. Besides insuring the benefits referred to above, the right kind of a feed-water heater will very materially improve any feed-water supply—no matter how bad—by eliminating some, or all, of the scale-forming matter present in the water, and by saving the exhaust condensed in accomplishing the heating. The Harrison Safety Boiler Works, Philadelphia, have collected a large amount of material on this subject, and in an attractive pamphlet which they have issued devote considerable space to the "deadly parallel" method of proving the excellence of the Cochrane Heaters. The remainder of the book is devoted to illustrated descriptions of various forms and different modes of installation, and the whole will prove of interest to all steam users.

SOME DICK, KERR & COMPANY CONTRACTS.—The Grimsby & Cleethorpes Tramways have just commenced work on the re-equipment of their lines for electric traction, and have placed the contract for the power house equipment, for the construction of the lines and for the supply of the rolling stock in the hands of Dick, Kerr & Company. The Nottingham (England) corporation tramways will very shortly commence operation. The scheme is an extensive one, involving the conversion of a considerable mileage now in operation with horse traction, and numerous extensions of the existing system which are being undertaken by the corporation. The current for the operation of the line will be taken from the existing 500-volt supply of the Corporation Electricity Works. Orders for fifty-seven completely equipped motor cars of the improved Preston type were placed some time ago with Dick, Kerr & Company, and these will be manufactured, together with the motor equipments, at the Preston Works. The Leeds (England) corporation tramways, one of the first and most important of electric traction undertakings in Great Britain, has had an important function in showing the essentially profitable nature of the conversion from horse and steam to traction by electricity. The corporation is rapidly extending its lines, and has now an order with Dick, Kerr & Company for one hundred completely equipped motor cars, to be manufactured at Preston, all of which will be in operation by the end of the present year.

"CROWN" RAIL BONDS.—The simplicity of the "Crown" bonds furnished by the Washburn & Moen department of the American Steel & Wire Company, Chicago, is doubtless the key to their widespread adoption in the construction of electric railways and tramways. Taken for granted that the copper of which they are made is of standard conductivity, and that the company is able to furnish every style of bond, solid or flexible, for bonding over or under the fish-plates, under rails, or for cross-bonding, the simplicity of application must account for the popularity these bonds have attained. When it is noted that the work of applying "Crown" bonds is all done on one side of the rail, and that only one man is required to handle and properly attach the bond, the economy effected on the score of labor alone is a very considerable item in every mile of bonding. Perhaps one of the greatest labor-saving points in connection with the "Crown" bonds is in rebonding work, which is the ability to dispense with all helpers. The ability of one man to handle the rebonding without assistants is a point in economy which cannot be overlooked by street railway superintendents and contractors. A catalogue, or little booklet, on "Crown" bonds will be sent free to anyone writing for same to the American Steel & Wire Company, at either the Worcester, New York or Chicago offices, and the company will be glad to extend the services of its expert electrical engineers to facilitate by suggestions the settlement of all questions regarding either bonding, line wires, feeders, or any electrical work for light or power plants, whether aerial, underground or submarine.

THE PARTICULAR FEATURES OF THE BLOWER SYSTEM of mechanical ventilation and heating are thus summarized in a recent lecture by Walter B. Snow of the engineering staff of the B. F. Sturtevant Company, Boston, Mass.: "The entire heating surface is centrally located, inclosed in a fireproof casing, and placed under the control of a single individual, thereby avoiding the possibility of damage by leakage or freezing incident to a scattered system of steam piping and radiators. The heater itself is adapted for the use of either live or exhaust steam, and provision is made for utilizing the exhaust of the fan engine, thereby reducing the cost of operation to practically nothing. At all times ample and positive ventilation may be provided with air tempered to the desired degree. Absolute control may be had over the quality and quantity of air supplied. It may be filtered and cleansed, heated or cooled, dried or moistened at will. By means of the hot and cold system the temperature of the air admitted to any given apartment may be instantly and radically changed without the employment of supplementary heating surface. The pressure created within the building is sufficient to cause all leakage to be outward, preventing cold inward drafts and avoiding the possibility of drawing air from any polluting source within the building itself. By returning the air, using live steam in the heater and operating the fan at maximum speed, a building may be heated up with rapidity, as is usually desirable in the morning. The area of heating surface is only one-third to one-fifth that required with direct radiation, while the primary cost and operating expense of a fan is far less than that of any other device for moving the same amount of air."

THE CHLORIDE ELECTRICAL STORAGE SYNDICATE, LTD., London, England.—The syndicate shows a large and varied assortment of its manufactures at the Paris Exposition. It includes large cells of perhaps 4,000,000 watt-hours or 5,000,000 watt-hours' capacity, such as are used by corporations, electric light and power companies, large private installations, as well as the very small cells used in the most delicate surgical operations. The exhibit of larger cells comprises similar ones to those employed by the Manchester, Halifax, Bolton, Newport, Leigh and Saint Helens corporations and at Arundel Castle (probably the largest battery in the world for private mansion lighting). Chloride cells have been adopted by upward of 200 central light and power stations, making a total of more than 45,000 cells, and having 150,000,000 watt-hours' capacity. There are also specimens of the special Admiralty type cells manufactured by the syndicate for yacht lighting, which has been installed on H. M. Queen Victoria's yacht, H. R. H. the Prince of Wales' yacht and H. I. H. the ex-Empress Eugenie's yacht. A wooden tray contains a set of cells of the type and size used on the Birmingham Central Tramways. The chloride cell is the only one that has been able to stand the arduous work of this system, 900,000 miles having been covered by the cells. The average life of each set of cells in this service is about 25,000 miles. Various sizes of cells in glass and lead boxes are erected on one of the syndicate's standard two-tier wood stands, large central station type cells in lead boxes are erected upon a standard single tier stand, and a complete battery of thirty-three cells in glass boxes is erected complete upon a three-tier wooden stand. There are also shown numerous examples of the accessories and instruments necessary for the storage battery, comprising trays, insulators, supports, separators, bolt connectors, clips, hydrometers, voltmeters, etc. The syndicate has made great effort to have an attractive and instructive exhibit of storage batteries and fixtures, and that its endeavors have been appreciated by the judges is shown by the award of a gold medal which they have received.

"DIRIGO" is the distinguishing name given by the Ohio Brass Company, Mansfield, Ohio, U. S. A., to the insulating material which they employ in the manufacture of their overhead electric railway materials. It was first made commercially seven years ago, and much of the original output produced in the first few months of its manufacture is now in use; a service which, both long and severe, has done much to establish its present reputation. The ingredients, which are prepared from a formula adopted after much experiment, as well as the methods of handling them, in the course of making the completed insulation, have been so carefully guarded that although many attempts have been made to duplicate the Dirigo none has been as yet successful. In appearance the insulation is a dark green, and the word "Dirigo" appears in raised letters on the surface of each piece, thus plainly distinguishing it. The characteristics, which are those qualities pre-eminently required for the use to which it is put, are toughness, elasticity, non-conductivity of heat or electricity, imperviousness to moisture, and, most important of all, great durability when exposed to the elements. It has been tested in nearly every climate of the world, and is alike unaffected by the intense cold of Canada or the high temperatures of the tropics, the dryness of high altitudes or the fogs and dampness of the seashore. It was perfected, especially, as an insulating material for overhead trolley systems, and in that capacity fills every requirement, but is equally fitted for other purposes where a good insulator is necessary, such as for controllers, motors and dynamos. As yet, however, this is an undeveloped field, for the Ohio Brass Company, although its plant has been operated both day and night almost steadily, has not been able to fill orders promptly for its regular line of railway materials during the past year. The testing of the finished product plays a most important part in its handling, and is carefully and accurately conducted. All articles are given an electrical test ranging from 5000 volts to 10,000 volts, depending upon the use they will be put to, and those whose shape and size will permit are subjected to a mechanical test. For the high voltage a special alternating-current transformer, with the aid of a water rheostat, gives a graduated pressure from zero to 10,000 volts; the readings being taken from a voltmeter connected in the circuit. A Reihlé Brothers' machine is used for making the mechanical tests, and, if the device will stand as much, pressures up to 10,000 lbs. can be obtained. The severity of the tests and the care with which they are made is largely accountable for the high standard of excellence of Dirigo insulation and those articles in the construction of which it enters.

"MULTIPLEX" ELECTRIC HEADLIGHTS.—It is recognized by many that the use of electric headlights is much more convenient and economical for street railway purposes than is the use of the oil headlight, and it is also claimed by many that the efficiency of an electric headlight consisting of a 16-cp lamp and a parabolic reflector is not much more than the light obtained from the lamp alone. The reason given for this is, that a true parabolic reflector requires the source of the light to be practically a point, such as an arc light produces, or as is produced in less degree by a brilliant oil light. Therefore a regular locomotive headlight with an oil lamp will always be more efficient than the same headlight would be, fitted with an incandescent electric lamp of equal candle-power, because the reflected image of the latter is very much distorted and out of focus. The light of the oil lamp is more condensed, and consequently most of it is in proper focus with the parabola, while but a very small portion of the light of the incandescent lamp is in focus. It is for these reasons that the inventor of the "Multiplex" reflector conceived the idea of making a reflector which is adapted to the requirements of the incandescent lamp. The general form of the "Multiplex" reflectors is on the lines of a true parabola, and the multiplex improvement consists of so altering the form of the parabola reflector as to form a number of annular and concentric separate reflectors, which illuminate the distortion of the reflected image of the incandescent lamp, and the result is a reflector which is several times as efficient as an ordinary parabolic reflector. "Multiplex" reflectors have now been on the market little more than one year and have attracted the attention of street railway managers everywhere. Their introduction and adoption have been extremely rapid. The cost of headlights fitted with these popular reflectors being on a par with that of ordinary headlights, they are very naturally preferred and adopted in competition with the latter. "Multiplex" reflectors for railway headlights are constructed in accordance with scientific principles. They are spun out of a heavy gage of brass, and their form consists of a series of convex and concave corrugations of shape, size and radius varying with the style and kind of light to be used in combination therewith. They are polished, heavily silver plated, and then burnished, or nickle buffed, and are finished in such a manner as to maintain a lasting brilliancy. Each one of the concave corrugations performs the functions of a separate and distinct reflector, reproducing the light in a greatly magnified and intensified beam, the beams from each corrugation merging into those of the other corruga-

tions, and this multiplication of separate beams of light is the secret of the intense light produced by the "Multiplex" reflector headlights. Two kinds of rays are projected from this reflector. One set of rays forms a bright beam of great intensity, projected in a comparatively small field and penetrating to a great distance, while the other set of rays has a much larger field of less intensity. This feature makes the "Multiplex" headlights especially desirable for street railway purposes. The Multiplex Reflector Company makes a specialty of furnishing reflector shells to parties who may desire to substitute "Multiplex" reflectors in the cases which they now have.

The factory of the Multiplex Reflector Company is located at Cleveland, Ohio, a convenient and centrally located shipping point for all parts of the United States. The selling agents for these headlights and reflectors are: The W. R. Garton Company, Chicago; Western Electrical Supply Company, St. Louis; Morris Electric Company, New York, and Percy Hodges, Boston, Mass.

NEWS NOTES

CHICAGO, ILL.—The Suburban Service Company, of Chicago, has just been incorporated, with a nominal capital of $100,000. It is chartered to operate street railways. Gordon J. Murray, Harry H. Phillips and F. M. Walter are the incorporators.

CHICAGO, ILL.—The South Side Elevated Railroad has recently increased its equipment by the addition of thirty new cars.

CHICAGO, ILL.—The Metropolitan Elevated has received fifty-six new coaches, which will be put on at once.

FT. WAYNE, IND.—The promoters of the Decatur & Ft. Wayne Electric Railway have applied to the Board of Works for permission to enter the city. The company has already secured franchises in Adams and Allen Counties.

SOUTH McALESTER, I. T.—The Union Electric Railway Company, which was incorporated on Sept. 8, has completed its organization and elected the following officers: Eugene E. White, president; W. E. Browne, vice-president; J. F. Craig, secretary; W. G. Wiemer, treasurer. The company is now arranging for a survey of its proposed line. It will extend from South McAlester to Hartshorn via Krebs, Alderson, Buck and Cherryville, a distance of 25 miles. The capital stock of the company is $125,000, fully subscribed.

WORCESTER, MASS.—The Railroad Commissioners, after careful consideration, hold that the officials of the Webster & Dudley Street Railway and the Worcester & Webster Street Railway are responsible for the collision of cars of the two lines, which occurred at Webster July 4. The Board found that the Worcester & Webster Street Railway was operating its cars on the line of the Webster & Dudley Street Railway on the day of the collision under an oral understanding, which is against the law, and that no comparison of time tables or arrangement of a special schedule for that day had been made. The cars collided head-on, and two persons were killed and about thirty-five persons injured.

BOSTON, MASS.—The petition of the Boston Elevated Railway Company for permission to remove its tracks from Marlboro Street, on the Back Bay, has raised an interesting question. This is a fine residential street, and the abutters have always prevented the use of electric cars, so that it is the only place, except Onset, where there are horse cars. The cars do not pay, and a majority of the residents, as well as the company, favor the idea of removing the tracks. The general law provides, however, that a line shall not be given up unless equal facilities are furnished in some other way, and at the hearing on the matter the chairman of the Railroad Commission declined to rule that the question of electric cars was finally settled, hinting that it might be that the Board would have to recommend electrics as the only way of furnishing equal facilities, though he did not appear to think this course probable. The matter has gone over to Oct. 31 for further hearing.

ST. LOUIS, MO.—The Wellston, Creve Coeur Lake & Western Railroad Company has filed its acceptance of the order made by the County Court on June 26 last, and was given an extension of thirty days' time in which to furnish bond. The orders of the court granted the company a franchise for a branch line to Bridgeton. The work on the new line will begin immediately.

TRENTON, N. J.—It is officially announced that the New Jersey & Philadelphia Railway Company has secured entire right of way for its new electric railway to extend from Trenton to Philadelphia. Some portions of the system are already in operation, and the work of construction is proceeding as rapidly as possible on the remainder. The cars will run from Trenton to Morrisville over the Calhoun Street Bridge, from Morrisville to Fallsington over the Lower Falls Road, thence to Emilie, the connecting point with the Philadelphia & Bristol line, and by tracks and franchises of the latter to Holmesburg, where connection is made with the Holmesburg, Tacony & Frankford Electric Railway. The Union Traction cars run direct from Frankford to the center of the city.

DUNKIRK, N. Y.—The Dunkirk & Point Gratiot Traction Company has made application to the Council for a franchise for the construction of a number of new lines here.

NYACK, N. Y.—The Rockland County Traction Company, recently incorporated to construct an electric railway in Nyack, Upper Nyack and near-by towns, has elected the following officers: C. W. Reeve, president; F. H. Reeve, vice-president; E. B. Harris, secretary and treasurer.

CLEVELAND, OHIO.—The Cleveland, Elyria & Western Electric Railway Company has decided to extend its Berea branch to Medina, a distance of 17 miles. An effort will be made to secure a franchise granted some time ago to Joseph Roof for a line along the Wooster Pike from Cleveland to Medina, passing through Strongsville and Brunswick. If this cannot be secured a private right of way will be purchased.

CINCINNATI, OHIO.—Tom Johnson is said to be interested in a company which is seeking a franchise for an electric railway from Cincinnati to Red Bank. Another company is after the same right of way, but thus far Johnson's company seems to have the advantage, having offered to build a double-track railway and to sell ten tickets for 25 cents, or a single fare for 3 cents.

BEDFORD, OHIO.—V. A. Taylor, of Bedford, the chief promoter of the Bedford-Ravenna Electric Railway, has made application to the County Commissioners for a franchise for the construction of an electric railway through Twinsburg and Hudson Townships, on a route from Bedford to Ravenna. The company desires a fifty-year grant and the right to lay a double track.

XENIA, OHIO.—The Dayton, Springfield & Urbana Electric Railway Company and the Springfield & Hillsboro Traction Company have both applied to the Commissioners of Green County for a franchise through the county from Jamestown to Cedarville. The Commissioners want a line through Xenia, but neither company will agree to this provision.

AKRON, OHIO.—The Portage Lakes Traction Company has applied to the County Commissioners for a fifty-year franchise. The Commissioners demand that several changes be made in the conditions, and they are not willing to grant more than a twenty-five year franchise.

COLUMBUS, OHIO.—The Columbus, Mount Sterling & Chillicothe Electric Railway Company has applied to the County Commissioners of Franklin County for an extension of time in which work must commence under the company's franchise. The company has been unable thus far to secure a city franchise.

MANSFIELD, OHIO.—The new Shelby-Mansfield Electric Railway has been placed in operation. The portion of the road from Mansfield to Rocky Run will be operated for the present.

NEW KENSINGTON, PA.—The Creighton, New Kensington & Springdale Street Railway Company has awarded the contract for the construction of its proposed road to the Tennis Construction Company, of Philadelphia. The new line will connect with the Tarentum & Natrona trolley line, and extend south, with a loop across the Allegheny River to New Kensington and Aspinwall, where connections will be made with the Consolidated Traction Company's lines to Pittsburgh.

CONNELLSVILLE, PA.—Work has been begun at Dunbar on the Mount Pleasant, Connellsville & Uniontown Street Railway Company's line, and the connection between Graham's Crossing, the terminal of the Connellsville, New Haven & Leisenring Street Railway and the Uniontown line will be rushed to completion. A gang of workmen are putting down the girder rails in Connellsville. The girder-rails and paving are being laid on Main Street, and it is currently reported that the new line will be built out as far as Moyer, and possibly Pennsville, this fall.

McKEESPORT, PA.—It is announced that the McKeesport & Youghiogheny Street Railway Company, which now operates a line between McKeesport and Buena Vista, and which the company intended to extend to West Newton, will, during the coming year, extend its road to New Haven, opposite Connellsville. The company has arranged to put in a number of aluminum feeder lines.

CHARLOTTESVILLE, VA.—The Charlottesville City & Suburban Railway Company has been reorganized, and the following officers elected: R. P. Valentine, president; H. C. Marchant, vice-president; F. A. Massie, secretary and treasurer; R. R. Case, general superintendent. Having acquired more property, including a park and hotel, it is the intention of the company to make improvements both on the line and the property acquired.

SEATTLE, WASH.—For several weeks past the Seattle Electric Company has been losing copper wire, and the thefts are said to have amounted to several hundred dollars. The officers of the company have made every effort to apprehend the miscreants and believe that they have at last run down the offenders. Four linemen in the employ of the company are charged with the offense.

TWO RIVERS, WIS.—Thomas Higgins, of Neenah, has been successful in his efforts to obtain a franchise here. The Council granted him the right to construct an electric railway to Manitowoc, on Sept. 21. Mr. Higgins expects to have the line in operation by July 3, 1901.

WAPAKONETA, WIS.—L. M. Coe, F. D. Carpenter and Jacob Mayer, of Cleveland, have been granted a franchise for the construction of an electric railway here. It is the ultimate intention of the promoters to extend the line to Lima, Minster and Cridersville. The franchise requires that the line be in operation by December, 1901.

CANADIAN NOTES

WELLAND, ONT.—The Niagara, St. Catharines & Toronto Railway Company has been granted an extension of time to May 1, 1901, in which to complete the Niagara Falls, Westley Park & Clifton Electric Railway on Murray Street.

SELKIRK, ONT.—The Selkirk Electric Railway Company has been very successful in securing franchises and right of way from the municipalities along its proposed route from Winnipeg to Selkirk. The overhead trolley system will be used, and the company will shortly be in the market for rails, cars, etc.

OTTAWA, ONT.—The Ottawa Electric Railway Company is about to extend its present system from the Rockcliffe Ranges to Besserer Grove.

NIAGARA FALLS, ONT.—The Niagara, St. Catharines & Toronto Electric Railway Company inaugurated through service between Niagara Falls and St. Catharines Sept. 24. A dozen round trips were made, and the cars were well filled.

SARNIA, ONT.—The Sarnia Street Railway Company has elected new officers as follows: J. D. Beatty, president; James Flintoft, vice-president; H. W. Mills, secretary, treasurer, purchasing agent, manager and superintendent. The company is now equipping its lines with electricity.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

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The Convention of the A. S. R. A.

The convention of the American Street Railway Association opened at Kansas City, at 11:15 a. m., on Tuesday, Oct. 16, with President J. M. Roach in the chair. Mayor Reed delivered an address of welcome, in which he referred to the growth of railways in Kansas City, and their beneficial effect upon the city. The presidential address, which followed, was highly interesting, containing, as it did, quite a number of statistics, which were very flattering to the large body of street railway men who had the pleasure of listening to them. President Roach said that the total railway investment of America alone represents $1,800,000,000, which paid dividends amounting to $70,000,000; the wages paid to the 300,000 employees who were required to operate these vast properties were estimated at $250,000,000 per year. In the course of his address President Roach urged amicable relations between the management of railway companies and their employees; and he also pointed out the advantages of co-operation between the railways and the traveling public.

After the reading of the reports of the executive committee and of the secretary and treasurer the first paper was presented. It was entitled "Consolidation of Street Railways and Its Effect Upon the Public," and was read by Daniel B. Holmes, counsel, Metropolitan Street Railway Company, Kansas City. He pointed out the economies resulting from the consolidation in the management of street railways, both in regard to the generation of power and its distribution, and in the stimulation of traffic. He thought that the benefit derived by the public from the generous extension of the transfer system could not fail but be reflected back upon the railway company. No discussion followed the reading of this paper.

The afternoon was pleasantly spent in renewing old friendships and making new acquaintances, and in the evening a delightful reception was tendered the delegates at the Midland Hotel, the headquarters of the association while at Kansas City.

The meeting on the second day, Wednesday, was occupied by the reading of two papers by the secretary. The first, "A comparison of the Various Systems of Electrical Distribution for Street Railways," by C. F. Bancroft, electrical engineer, Massachusetts Electric Companies, Boston, Mass., was received without comment or discussion, but the second, "Painting, Repainting and Maintenance of Car Bodies," by F. T. C. Brydges, superintendent of car shops, Chicago Union Traction Company, elicited a few interesting remarks from W. E. Harrington, manager of the Camden & Suburban Railway Company, Camden, N. J., in which he made a short statement regarding the cost of repairs to cars. During the session the ladies were given a most enjoyable tally-ho ride to the Country Club.

The paper read Thursday morning by N. H. Heft, president Meriden Street Railway Company, Meriden, Conn., on "Double-Truck Cars: How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions," was quite generally discussed. In his paper Mr. Heft recommended the use of long double-truck cars holding sixty or more passengers. He spoke in favor of a car weighing but 473 lbs. per passenger, which is much lighter than the ordinary practice. Plans were shown of a novel construction for the car body, and also of a new type of truck which would make the system of operation proposed practicable. The discussion was participated in by E. C. Foster, Lynn, Mass.; E. Chamberlain, Brooklyn, N. Y.; W. E. Harrington, Camden, N. J.; E. G. Connette, Syracuse, N. Y.; H. H. Vreeland, New York; C. S. Sergeant, Boston, Mass.; I. A. McCormack, Cleveland, Ohio; R. McCulloch, Chicago. The serious illness of N. S. Hill, Jr., general manager Charleston Consolidated Railway, Gas & Electric Company, which kept him away from the convention, prevented his preparing the paper for which the programme called.

After the close of the discussion following the reading of Mr. Heft's paper, the regular election of officers for the ensuing year took place. Walton H. Holmes, president Metropolitan Street Railway Company, Kansas City, was elected president of the association, the other officers being as follows: First vice-president, H. H. Vreeland, president Metropolitan Street Railway, New York; second vice-president, N. H. Heft, president Meriden Street Railway Company, Meriden, Conn.; third vice-president, J. B. McClary, manager Birmingham Railway & Electric Company, Birmingham, Ala. The executive committee consists of Messrs. Roach, Chicago; Fuller, Wilkes Barre, Pa.; Baumhoff, St. Louis,

Mo.; Graham, Quincy, Mass., and Harris, Cincinnati, Ohio. The place of meeting selected for 1901 was New York City. A vote was taken in regard to the desirability of shortening the duration of the annual meetings, and it was decided in future to hold the convention on only three days, instead of four.

On Friday, the day set apart for the benefit of the supply men, the delegates inspected the large number of exhibits with which Convention Hall was filled. In the afternoon they were entertained by a vaudeville entertainment arranged by the representatives of the various exhibiting companies. Many of these companies had engaged parlors in the Midland Hotel, where they hospitably entertained their friends among the delegates.

A great deal of credit is due the members of the various committees for the efficient manner in which the programme was carried out and the various entertainments arranged. The executive committee consisted of President J. M. Roach, Vice-Presidents J. A. Rigg, H. H. Vreeland and F. G. Jones; C. S. Sergeant, N. S. Hill, Jr.; C. W. Wason, J. R. Graham and W. H. Holmes. The other committees were made up as follows: Entertainment and banquet committee, W. H. Holmes, chairman; L. E. James, D. B. Holmes, F. Hagerman, J. K. Cubbison, F. Walsh, W. E. Kirkpatrick, H. W. Walcott, A. A. Lesueur, H. Fleming, A. M. Hopkins, C. A. Snider, U. S. Epperson, H. C. Ward, J. McGowan and R. L. Gregory. Reception and ladies' committee, C. F. Holmes, chairman; J. A. Brown, G. T. Stockham, C. F. Morse, W. H. Lucas, H. H. Medall, W. T. Osborne, J. W. Speas, F. C. Peck, H. Evans, R. M. Goodlett, S. H. Velie, J. A. Reed, L. Karnes, H. Friedberg and H. McGowan. Exhibit committee, W. A. Satterlee, chairman; C. W. Waddell, J. P. Loomas, H. C. Schwitzgebel, R. E. Richardson and F. M. Bernardin. Information bureau committee, J. O'Keefe, chairman; J. A. Harder, E. R. Royer and J. W. Mason.

The Meeting of the Accountants' Association

Auditor Kent, of Kansas City, opened the first meeting of the Street Railway Accountants' Association of America, which held its convention in Kansas City at the same time as the American Street Railway Association, with an address of welcome, in which he expressed his pleasure at the selection of the place of meeting. The president's address followed, and was succeeded by the annual reports of the executive committee and secretary and treasurer. The latter report showed that the members had taken kindly to the increase in the dues which was made last year. The first paper that was taken up was by John I. Beggs, general manager of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., and was entitled, "What Does the General Manager Want to Know from the Accounting Department?" Mr. Beggs gave an extended address upon this important subject, and brought out several practical points. He laid great stress on the desirability of having the head of the accounting department in accord with the manager's policy. He also expressed the opinion that it was right to make public the reports of earnings and expenses, and that he thoroughly believed in the benefits that would be derived therefrom.

At the session Wednesday morning C. O. Simpson, auditor, Augusta Railway & Electric Company, Augusta, Ga., read a paper on "The Routine of a Street Railway Electric and Gas Lighting Company," and Chairman H. C. Mackay, comptroller, Milwaukee Electric Railway & Light Company, Milwaukee, Wis., read the report of the committee which had been appointed to investigate the question "Is a Standard Unit of Comparison Practicable?" The long discussions which followed both of these papers, and in which all participated, prevented the presentation of the paper by H. L. Wilson, auditor, Boston Elevated Railway Company, Boston, Mass., on "Departmental Accounts," which was, consequently, held over until Thursday's meeting. In the course of the discussion of Chairman Mackay's report, H. H. Vreeland, president, Metropolitan Street Railway, New York, expressed the opinion that the accountants were better able to decide upon a standard than were the managers, but should such a standard be adopted it would most certainly receive his earnest consideration. C. L. Rossiter, president, Brooklyn Rapid Transit Company, Brooklyn, N. Y., also made a few pertinent remarks on this subject. It was finally decided to try the "car hour" for a year, and report the result at the next convention.

The first part of the session Thursday morning was taken up by the reading of Mr. Wilson's paper, and one on "Material and Supply Accounts," by W. M. Barnaby, accountant Brooklyn Rapid Transit Company, Brooklyn, N. Y. A short informal discussion was then held upon subjects of interest to the delegates, the reports of convention committees were read and the election of officers took place. The result of the election was as follows: President, W. F. Ham, Washington, D. C.; vice-presidents, Messrs. Harden, Kansas City; Smith, Toronto; McDole, Cleveland; executive committee, Messrs. Duffy and Hemenway, New York; Tripp, Seattle; Mitchell, Pittsburgh. The same place was chosen for the next meeting as selected by the American Street Railway Association, New York, and the convention then adjourned.

A most imporant feature of the Accountants' Association's convention was the extremely interesting collection of blanks and forms which was exhibited. These were contained in sixteen large books, which were placed on a long table near the meeting room, and were carefully examined by the delegates.

Toy Hoop Causes Temporary Suspension of Traffic in Washington

Traffic had to be temporarily suspended on part of the system of the Washington Traction & Electric Company, of Washington, D. C., Oct. 4, because a steel hoop, which was being rolled by a little girl, fell into the conduit. Current had to be shut off until the hoop could be extracted, and meanwhile the child was lamenting her loss. As a result of this experience a police order has been issued prohibiting the rolling of hoops in Washington.

Brooklyn Power House Damaged by Fire

The power house of the Brooklyn Rapid Transit Company, situated on Third Avenue, between Second and Third Streets, was badly damaged by fire Oct. 3. The fire was caused by a short circuit, and three alarms were turned in at fire headquarters. The big switchboard was destroyed, and the damage is estimated at $35,000. The fire occurred at 11:15 a. m., and fifteen lines of cars were tied up until connections were made with the company's Kent Avenue station.

Unique Electrical Effects in a Cleveland Celebration

In addition to the street illuminations, the most striking and unique electrical displays made during Cleveland's "Home Week" celebrations last week were those made by the Cleveland City Railway Company. One of these was the private car of the directors of the company, beautifully decorated with numerous colored incandescent lamps. The ends of the car were decorated with immense signs bearing the words "Cleveland's Population 381,768." The other attraction was even more novel, being a marching club composed largely of street railway men. Each man carried an incandescent lamp, the officers having two or more. The lamps were connected in series of five, the wires running around on the outside of the marching column and each man holding a wire. There were 125 in all. The circuit was obtained through a long trolley pole to the wires above on one side, with a ground to the car tracks below on the other. The ground connection was made through a short pole, having at the end a half section of a trolley wheel. The lights were of various colors, while at the head of the column was a sign bearing the words C. C. R. R. Escort Club" in white incandescents. The idea was devised by Fred Feld, an electrician of the company.

A French Sprague Company

The demand abroad for American electric railway apparatus and methods is strikingly instanced by the organization of different European companies to handle exclusively American ideas and devices. The number of these companies has been increased recently by the formation in Paris of an organization to be known as the "Société Francaise Sprague." This company, which has ample financial backing, will undertake, immediately and on a large scale, a practical demonstration of the operation of the multiple unit system control, as developed by the Sprague Electric Company, of New York. Its offices are at 6 Rue de Madrid. The president is M. M. Monthiers, the vice-president is M. J. Micart, and among the directors are directors of the Comptoir National D'Escompte, the Banque de Consignation, and the Société Breguet.

To carry out the initial purposes of this organization there have recently been shipped to Paris about 60 tons of trucks, motors, controllers, etc., which are now being installed by Frederick Brush, one of Mr. Sprague's former assistants, on a trial train on the Western Railway of France. When completed this train will be put into operation on the Versailles division of that

road, on the branch running from the Quai d'Orsay, which branch is already equipped with a third-rail supply for about 27 miles, and is supplied from a modern high-powered station at Moulineaux. This is the same line on which two-car train units are now operated with a hand control at each end, the main controlling circuits being carried from car to car, and for which a number of electric locomotives are being built by four different companies for tests. It is expected that the demonstration made on this line will be far reaching in its influence upon railway development on the Continent. In addition to this demonstration, a trial train on the Sprague Multiple Unit System will, in the near future, be operated on the new Berlin Railway under the auspices of the Siemens & Halske Company.

The Metropolitan Street Railway Association's Entertainment

On the evening of Saturday, Oct. 6, this association entertained the families and friends of the members with a vaudeville exhibition at Carnegie Hall. The performance celebrated the fourth anniversary of the association, and the immense auditorium was crowded to the doors by a most enthusiastic audience. As is customary at these meetings, President H. H. Vreeland welcomed the guests in a few well chosen remarks followed by a short but expressive address to his employees and their associates. Mr. Vreeland's efforts as a leader in the cause of uplifting labor and the practical sympathy for the men which his own elevation from the ranks gives him, peculiarly fit him for an address of this kind; and the vigorously applauded words of praise, caution, fellow-feeling, gratitude and admonition reflected his true emotions in a manner that few other occasions could produce. In the course of his remarks he advised his employees to be wary of false promises made by outside interests, reminding them that his counsel was always at their disposal, and that he knew their aspirations for themselves and families. After the applause which followed Mr. Vreeland's closing sentence had subsided, the entertainment was continued by the introduction of some of the best theatrical talent from the New York stage.

The Metropolitan Street Railway Association was organized four years ago by the employees of the company, and has increased in membership from 100 to 3312. Its objects are to secure to its members free medical attendance, about one-half of their usual wages when illness overtakes them, and $150 in case of death. There are no paid officers, and the members, therefore, receive a larger percentage of the dues paid than in other mutual assessment associations. The monthly cost of membership is but 50 cents, a scarcely perceptible tax on any man in steady employment. The association has already paid out in benefits $43,916; owns five bonds of the Metropolitan Street Railway Company, from which it receives an annual income of $250; has a bed in St. Vincent's Hospital, the gift of President Vreeland, and controls a circulating library of 1300 volumes. The annual reports of the secretary and treasurer were presented at the meeting.

Supreme Court Decides in Favor of the Milwaukee Company

The Supreme Court of Michigan has just handed down a most important decision in which it reverses the decision of Judge Ludwig, and upholds the 4-cent fare and franchise-extension ordinance granted to the Milwaukee Electric Railway & Light Company by the Common Council. The decision is a sweeping one and a clean-cut victory for the company; it is also of special interest to street railway companies at large, because of the important points involved.

The opinion of the court is based upon the discretionary power of the Common Council, as granted in the city charter, to determine what shall be the best interests of the citizens as a whole, the Supreme Court holding that this power is absolute and cannot be questioned in any court, so long as no wilful waste or squandering of public property, rights, or funds can be shown. Regarding the $100,000 offer by an independent company, the court ruled that this was also a matter entirely within the discretion of the Council, and that it may have acted wisely in refusing it, because a new company would find it almost impossible to give as complete and thorough a service to the citizens as the established one. The court holds that the franchise is valid, and that the street railway company may proceed with its line extensions, which will require an expenditure of more than a quarter of a million dollars, at once. On every point raised the Supreme Court rules in favor of the street railway side of the case. Of the constitutionality of the franchise the opinion says: "Another claim is that the ordinance is unconstitutional because it is in effect a special or private law granting corporate powers or privileges, and so prohibited by Section 31 of Article 4 of the constitution. The argument is that the ordinance attempts to confer corporate powers and privileges, and that it is a special act of legislation; that in enacting it the City Council was simply exercising legislative power attempted to be delegated to it by the State; that under the constitutional provision above cited the Legislature itself could pass no such law, and that the City Council can possess no greater power than the Legislature. While such franchises as were here granted are legislative grants, they are not corporate powers or privileges within the meaning of the constitution. When granted to a corporation they become the property of the corporation, and so may be called franchises of the corporation; but they are not franchises essential to the existence and granted as part of the organic act of incorporation."

The Special Train to Kansas City

A large party of delegates to the nineteenth annual meeting of the American Street Railway Association left New York on Sunday, Oct. 14. As it pulled out of the Grand Central Station at 10 a. m., the special vestibule train which had been placed at the disposal of the committee on transportation was one of the finest ever made up by the New York Central & Hudson River Railroad, and carried nearly all the prominent street railway men of the vicinity. The train consisted of baggage cars, a combination smoking and buffet car, a dining car, four Pullman drawing-room sleeping cars, and a private car. The dining car accompanied the party all the way to Kansas City, so that there was never a delay in the serving of meals, and no doubt as to the quality. The success of the train was largely due to the personal efforts of Milton C. Roach, general Eastern passenger agent of the New York Central & Hudson River Railroad, who accompanied it from New York to Albany.

The private car was occupied by H. H. Vreeland, president of the New York State Street Railway Association, and a few friends. Among the other prominent railway men who composed the party, or joined it *en route*, may be mentioned C. L. Rossiter, president of the Brooklyn Rapid Transit Company; Col. N. H. Heft, chief of the electrical department, New York, New Haven & Hartford Railroad; E. G. Connette, vice-president and general manager of the Syracuse Rapid Transit Company; H. H. Littell, of Buffalo; H. S. Cooper, of Ithaca, and C. S. Blackman, of the Big Four Railroad. Other names which appeared on the list of passengers and are familiar in street railway circles were: E. Peckham, of the Peckham Motor Truck & Wheel Company, New York; H. F. J. Porter, of the Bethlehem Steel Company, Bethlehem, Pa.; R. H. Beach, of the General Electric Company, Schenectady; F. D. Russell, of the Rochester Car Wheel Works, Rochester, N. Y.; J. M. Jackson, of the Jackson & Sharp Company, Wilmington, Del.; Col. A. C. Woodworth, of the Consolidated Car Fender Company, Providence, R. I., and J. H. Stedman, of Rochester. W. H. Welch, traveling passenger agent of the New York Central & Hudson River Railroad, went through to Kansas City. Many ladies, wives and friends of the delegates, accompanied the party, and, while enjoying the trip themselves, greatly increased the pleasure of their companions.

The New England contingent came through in a special car from Boston, and joined the main train at Albany. The addition thus made included Hon. E. P. Shaw, Newburyport, Mass.; E. C. Foster, vice-president and general manager of the Lynn & Boston Railroad Company; C. S. Sergeant, vice-president of the Boston Elevated Railway Company, and H. L. Wilson, auditor of the same company; E. A. Newman, secretary and treasurer of the Portland Railroad Company; R. S. Goff, president Globe Street Railway Company, Fall River, Mass.; C. N. Wood, vice-president of the Frank Ridlon Company, Boston; J. A. Granger, Boston Car Wheel Company, Boston; H. L. Rideout, Walworth Manufacturing Company, Boston; and G. C. Tripp, auditor, and C. F. Wallace, engineer, of Stone & Webster, Boston.

Special cars were also sent from Chicago over the Atchison, Topeka & Santa Fe Railroad and from Philadelphia over the Pennsylvania Railroad. The former carried J. M. Roach, president of the association, and the latter some twenty to twenty-five people from Philadelphia and neighboring cities, including C. E. Flynn, E. W. Ash, H. C. Moore, W. E. Harrington, F. W. Darlington, C. J. Mayer, F. B. Musser, W. H. Heulings, Jr., J. B. MacAfee, J. W. Perry, and C. A. Bragg.

The unavoidable delays which so often interfere with the running schedule of a special across the country caused the train to lose a few hours before St. Louis was reached. The time, however, was not missed by the passengers, but passed quickly for the numerous groups of old friends into which the family party had naturally divided itself. The Bullock Electric Manufacturing Company increased its popularity during the ride by the distribution of highly appreciated "souvenirs" in small glass receptacles. Finding that the train could not arrive in Kansas City until late at night the transportation committee made arrangements with the Wabash Railroad officials to hold it in St. Louis until 10:15 p. m., thus giving the delegates several hours in St. Louis, which were greatly enjoyed. The party arrived at its destination at 7 o'clock Tuesday morning, which gave the members plenty of time to refresh themselves after their long ride from the East before taking their places in Convention Hall.

Ninth Annual Convention of the Pennsylvania Street Railway Association

The ninth annual convention of the Pennsylvania Street Railway Association was held at Reading, Oct. 10 and 11, and was attended by about 150 persons. The sessions were held in the Mansion House. The association was called to order at 2 P. M. on Oct. 10 by President Given, after which the delegates listened to an address of welcome by Mayor Leader of Reading. To the mayor's welcome a fitting reply was made by William B. Given, Lancaster, president of the association. The regular proceedings of the association were then begun.

An interesting paper on "Railway Joints and Tracks" was first presented by George L. Hall, of the Weber Railway Joint Manufacturing Company. This paper is published elsewhere in this issue.

The second paper on the programme was by Samuel D. Missimer, chief engineer of station motive power of the United Power & Transportation Company, who spoke upon "The Successful Station Manager and His Responsibilities." This is also published elsewhere. Both papers were discussed at length. Other topics of interest to the members were considered, after which reports were received from Secretary S. P. Light, Treasurer W. H. Lanius and the several committees.

Addresses were made by William B. Given, Lancaster; W. H. Lanius, York; J. H. Stedman, Rochester, N. Y.; Major S. E. Ancona and William D. Smith, Reading.

Then followed the election of officers, which resulted as follows: president, John A. Rigg; first vice-president, E. H. Davis, Williamsport; second vice-president, A. L. Johnson, Allentown; secretary, S. P. Light, Lebanon; treasurer, W. H. Lanius, York; executive committee, John A. Rigg; William B. Given, Lancaster; W. H. Lanius, York; B. F. Meyers, Harrisburg. This closed the business session.

In the evening at 8:30 o'clock the guests and hosts and a number of Reading's most influential business men assembled in Rajah Temple, where a most sumptuous banquet was enjoyed.

When the covers were removed, Richmond L. Jones was made the toastmaster and the list of toasts was begun. Mayor Leader responded briefly to the toast, "The City of Reading." Richmond L. Jones followed, his subject being "Welcome to Our Guests." President Given then spoke and complimented Reading upon having one of the best equipped and best managed railways in the State. He also referred to the princely hospitality shown by the Union Traction Company in entertaining the association and other attendants at the convention. Mr. Rigg, the president-elect, then addressed the guests and thanked his associates for the honor conferred upon him. He introduced John D. Missimer, who responded to the toast, "The Press." "Our Ladies" was the toast assigned to J. H. Stedman, and it was delivered in his own inimitable way and caused roars of laughter. Impromptu remarks were later made by Major Brennan, of Lancaster; Hon. W. Willis Bland and William Rosenthal, of Reading. The assembly then sang "Auld Lang Syne" and dispersed.

On Thursday morning the atttendants were given a trip by electric cars to the Neversink Mountain House, over one of the most picturesque routes in the country. The weather was ideal for a trip of this kind, and it was heartily enjoyed by all. In the afternoon, again as guests of the United Traction Company, an excursion was made by special cars to the Mt. Penn Gravity Railroad, at the summit of which the visitors had the opportunity to view the city and its beautiful surroundings. Upon returning to the city, the party proceeded on a trolley ride to Womelsdorf and return. The Christensen Engineering Company, of Milwaukee, Wis., has equipped a large number of the cars at Reading with motor compressors and air brakes, and F. C. Randall, of that company, improved the opportunity to invite a number of the railway managers to take a trip in one of the closed cars on which they had been installed. The car was started and stopped quickly on grades, and many favorable remarks on the working of the system were elicited.

The convention was one of the most successful and largely attended in the history of the association, and the bounteous hospitality offered to all by the Union Traction Company was heartily appreciated.

The Successful Station Manager and His Responsibilites*

BY SAMUEL D. MISSIMER

The station manager of to-day must be honest and sober, positive in character and approachable, thoroughly conversant with the modern and ancient machinery which constitutes the ordinary power-house equipment.

The wondrous machinery, both steam and electrical, installed to-day for electric traction and electric light service, makes it mandatory on the part of the manager to fully acquaint himself with every detail of its construction and operation, in order to be fully independent and capable to render a continuous and efficient service to the public, and an economical, careful and safe management of the property.

It is criminal to-day to suffer the abuse of good machinery, and a competent manager will excuse no one for a flagrant transgression that may mean interruption of the service, to say nothing of loss of property. It is required of managers to-day to allow no man in his employ who does not fully appreciate the importance of faithfully rendering his full duty, or any other man's duty, if necessary, about the station.

It is required of managers to unceasingly promote discipline (not abuse) by truth and sober thought, and to impart to all employees information which will lead to a full understanding of what is needful to promote the greatest economy of station operation, the care of the machinery and an uninterrupted public service. The employees must be held accountable for many things, but, at the same time, managers must not run away from trouble. On the contrary, it should be a proud satisfaction to surmount the ups and downs, serious and otherwise, that come to all who are in authority.

Managers should be able to supervise the detail requirements that constitute the general make-up of station equipment. He should be in a position to suffer no imposition by reason of unnecessary repairs to machinery or the buying of any material not consistent with safe and continuous service. He must, by personal inspection, be able to pronounce judgment upon any disorganized machinery and to tell the extent of repairs needed. The pencil and tablet must accompany him upon his daily rounds without fail; the eagle eye will detect any disorganization about the station, and good management will prompt its immediate looking after and repair.

A careful supervision of the installation of new equipment is highly incumbent upon the manager. No time is lost, which is used in exacting careful erection of machinery. The writer has personally observed the most slovenly disregard in erecting new machinery, which foreordained much trouble and anxiety for those who should have been exempt from the results of such indifference.

Station managers have no time for vacations as long as the general public is not through with theirs. Absence from station supervision at the busy season is a mistake. Then, above all other times, there must be careful watchfulness to assure continuous and good service.

Managers must be content with whatsoever they may have as station machinery so long as it is equivalent to the service demanded. All things being equal, in the absence of an unavoidable accident, there is little excuse for the interruption of continuous service, and there will be few mishaps to the service where the manager educates his people to their full responsibilities.

Railway Joints and Track †

BY GEO. L. HALL

Most managers of electric railway systems realize that good track is absolutely necessary. Not only is this fact forcibly illus-

* Paper read before the Pennsylvania Street Railway Association, Oct. 10, 1900.

† Paper read before the Pennsylvania Street Railway Association, Oct. 10, 1900.

trated by the increased wear and tear on the rails, joints, bonding, etc., where bad construction is used, but no small item is the damage to the rolling stock.

The best track that can be constructed is that which is absolutely free from any movements or impacts that can be prevented by the judicious use of the proper material and labor. Different conditions of heavy weights moving at high velocities must be dealt with, and any failure to provide accurate gage, correct line and true surface will result in increased damage to both track and equipment. The structure must be adequate for the load and speed which it is expected to stand. The track is not primarily injured by the weight of the car, as weight in itself is an element of stability. Heavy weights moving at high speed striking irregularities of surface or line produce shocks and impacts which constantly multiply these defects and make the condition worse and worse. Therefore the management is justified in any additional outlay for labor and material that will reduce such irregularities in line or surface, and these facts should not be overlooked when considering first cost.

The general condition of track must not be judged altogether by how long it has been constructed or how lately worked over, but we must take into consideration the number of cars passing over, the kind of motive power used, and if in a city, the character of the street and street traffic.

There are many seemingly unimportant details that enter into the construction and maintenance of good track, and there is no part of a railway that requires more careful or painstaking observation and scientific methods of investigation in order to secure the desired results at a minimum cost. From experience, the writer is of the opinion that too much attention cannot be given to accurate gaging. Many apparent imperfections in track are due entirely to irregularities of this kind. Especially is this the case on suburban lines and track constructed where there is no paving to assist in holding it to line. No matter how true the surface and alignment may be, if the gage is not accurate, poor riding track and more or less oscillation of the car will result.

As a rule there are not many cross-overs or turnouts on electric railway lines, but a word about gaging at frogs would not be amiss. The proper alignment at such places is more important than it is generally considered to be. The practice of leaving the gage a little wide at the frog-point should not be followed except where the conditions demand widening, and when such action is necessary the guard-rail distance should also be increased exactly as much as the gage is widened. It is an error to suppose that the all-important point is to make the guard-rail distance exact, without regard as to whether or not the gage is true. What should be kept in mind is the distance from the running-rail of the frog to that side of the guard-rail with which the wheel comes in contact. A frog may cause a noticeable lurch to the passing car when in exact position if the remainder of the track is too wide to gage, either from its natural tendency to widen or from poor construction.

Some evidences of imperfect gage are as follows: (1) When the frog receives a blow from the passing wheel or shows evidence of unnatural strain; (2) when near the end of the guard-rail there is an abrupt change from a badly worn rail to a full head; (3) where there is a similar mark at either end of the frog; (4) when the guard-rail or the wing-rail of the frog is unnaturally worn and it is difficult to keep in proper position.

It is to be regretted that too often in the construction of electric railways it is necessary to close up the track before it is possible to work over the same after it has been in use for a short time. Especially does this refer to the surface and general condition of the joints. When the track material is new we have a solid riding surface, but this is largely due to the general strength and stiffness of the material. In a comparatively short time, varying with the traffic, the track does not ride as well as should be expected; the rails are slightly out of line and surface; the joints begin to bend, more or less play having developed; a dip appears near the rail end, and the joints are low. Without taking into consideration the damage to equipment and the use of labor which otherwise might be available for the constant improvement of the road, we are face to face with the question of repairs.

Theoretically and practically, everything that has to do with track work is subordinate to perfect line and surface. Work to exact gage, perfect level and true line, with correct spiking, thorough tamping, good drainage and other details essential to their preservation, and one will be surprised at the good results that will follow.

One of the most important details of track work is the rail-joint, and under average conditions it is the weakest part of track construction. The amount of wear at the joint naturally depends on traffic. Once the fastenings begin to show failure they grow rapidly worse, and while weak, are not necessarily dangerous, but they cause a rough riding track, increase the wear of the rails and damage the rolling stock. Much of the ultimate deterioration of joints could be avoided if there was not a general tendency to purchase cheap material and keep down the cost, and if angle-bars are used proper attention should be paid to their design and general efficiency, especially as to bearing area. A joint is simply a fastening that holds together horizontally and vertically the ends of the two rails. In addition to being held up, the rail must also be held down. This fact is apparent from the manner in which angle-bars break. Investigation shows that 90 per cent of broken angle-bars break from the top down, this being caused by the leverage of the rail, the shoulder ties acting as a fulcrum. This action is augmented by the irregularities in the wave motion. The remaining 10 per cent of broken angle-bars have been broken from the bottom up by suddenly applied loads. In a perfect joint the construction must be such as to make the joint as strong and as stiff as the rail; at the same time the elasticity must be sufficient to carry the wave motion uniformly along the track and allow no permanent set or deflection to take place, the joint returning to its proper position after each passing load.

One great difficulty with the joint question has been to decide which is the best design, other conditions being equal. The original outline of the angle-bar, together with some combination giving base support and adding strength, has shown the best results.

If the rail and joint are of about equal strength and flexibility the wear on the ends of the rail is true, while if the joint is stronger than the rail the wave motion is broken and the wear at the joint is irregular. If the fastening is weaker than the rail the joint will become dipped and rail and joint kinked and worn.

Due allowance must be made for expansion and contraction, taking into consideration the fact that calculation of expansion and contraction must be based on the temperature of the rail itself, and not the temperature of the air at the time the rail is laid. Too much opening between rail ends is necessarily bad, and causes pounding. At the same time the elastic limit will not take care of great expansion and contraction.

It is estimated that the loss of energy caused by the resistance to traction offered by low joints is 2 hp-hours per mile of track. In addition to this there is the loss by wear and tear on cars, track material, etc. Therefore any increased outlay necessary to secure a good joint is more than balanced by the saving in the cost of maintaining the track and equipment.

Snow and Snow Plows*

BY RICHARD E. DANFORTH.

Our friend, the supply man, tells us that the proper time to consider the question of snow fighting apparatus is when the leaves are on the trees and the shirt waist man is in evidence. Following this very proper suggestion, your attention is called to some of the problems connected with the removal of snow and ice, with the hope that a comparison of experience will lead to a general improvement in the appliances used and the methods followed in handling this troublesome substance.

It might be stated as a general proposition that street railways have, in their snow plow equipment, failed to keep pace with their improvements along other lines. A dozen years ago it was thought sufficient to equip passenger cars with 10-hp motors. The severe strains placed upon these motors during winter months caused manufacturers to increase the capacity of motors from time to time, and this and other kindred reasons have led to the final adoption of motors averaging a capacity of 50 hp each.

Passenger car bodies and trucks have increased in dimensions and weight so that it is not an unusual thing at the present day to see in daily service passenger cars 40 ft. long, weighing, with motor equipment and trucks, 23 tons. Street railway managers and manufacturers have failed in many cases to realize that a car built to effectively remove snow from the tracks and ice from the rails must be heavier and equipped with more powerful motors than the passenger cars operating on the same lines. Five years ago a snow plow, equipped with two 35-hp motors and having a total weight of 6 tons or 8 tons, was considered a fine piece of apparatus for removing snow. These plows, during heavy storms, and with the aid of one or more passenger cars as pushers, have been able to keep a few miles of track clear. Experience has shown, however, that the plow above referred to is not perfection.

Each manager, aware of the defects in his snow fighting apparatus, has endeavored to make improvements, with varying re-

* Read at the convention of the New York State Street Railway Association, Buffalo, Sept. 18, 1900.

sults. A road at one corner of the State copies the steam road rotary snow plow. A road at the other corner of the State builds share and nose plows of great weight, and still another road tries sweepers.

In comparing notes with our neighbors, it will be well to remember that conditions vary in the different cities and parts of the State. What might give most excellent satisfaction in Binghamton might prove most unsatisfactory in Buffalo, and might not be permitted by the Common Council in Greater New York.

It might be well to first consider the different kinds of snow which usually falls during the three or four winter months, and its effect upon the transportation facilities of the locality. It is generally conceded that a wet snow is a bad snow, and that systems having grooved rails are most liable to be blocked by this snow. A wet December snow falling in considerable quantity, before the frost has fully entered the ground, puts a most severe test upon the capacity of the transportation department to keep the cars of a system in motion.

The first few inches' fall melts as it strikes the rail, and, in melting, cools the same. By the time 6 ins. have fallen, a coating of slush is formed over and about the rails, which, upon the passage of a wagon or other vehicle, whose wheels press out the moisture, becomes a coating of ice upon the rail and in the groove. The ordinary snow plow, equipped with gravity flanges or diggers, fails to make any impression upon this coating of ice, and usually lands in the gutter. With the usual equipment of one plow to from 5 miles to 10 miles of city track in streets where there is considerable wagon traffic, and the cars at frequent intervals, the result of the above conditions is a tip-up and a call for the track department with picks (and salt.)

The Toronto Railway Company successfully meets this situation by equipping its cars with track scrapers, which are not only supplied with a steel flange of proper form for removing ice from the groove, but are connected so that a powerful leverage can be placed upon them when required. These track scrapers cut the ice from the rail as easily and smoothly as a planer takes a cut from a piece of metal. Properly adjusted, they can be run through switches and around curves with safety.

Experience has shown many of us the necessity of equipping all snow plows with devices having the same action as the above described track scrapers, but we have yet to learn that the best way to meet this condition is to equip our passenger cars so that we may at all times be sure of having a clean track groove.

When the thermometer approaches zero the conditions change. With fine, dry snow, which forms hard drifts, but doesn't freeze nor attach itself to the rail, the difficulty then arises of obtaining sufficient traction between the frosted wheels and rail. Lightweight cars and plows make no headway without the use of sand, and at this time we find the advantage of weight in our equipment. The use of salt under these conditions but aggravates the case by the formation of slush, which sticks, and finally freezes, to everything it touches. Sand is but a makeshift, and soon causes trouble by filling up the grooves in the rail, and causing flat wheels; but it is of great service in keeping cars in motion, as well as in stopping them when under headway.

When the temperature is in the neighborhood of 20 degs., the falling snow is usually feathery and light, and easily handled. Two feet of this snow doesn't cause the trouble that 6 ins. of wet snow will make. The problem in removing this snow from the track during a heavy fall is one of having plows running at close intervals or those designed to remove from the track large quantities without delay. This snow drifts quickly and under a light wind. On lines operated through thinly settled districts and subject to large drifts, we find at this time a rotary of great value. A share plow will do the work perhaps more quickly during the first storm, but as the banks at the side become high, and are frozen solid (unless carted away), the share plow is of little service, having no place to shove the snow, while the rotary picks it up and scatters it to great distances.

SNOW PLOWS

A description of the various types of snow plows and snow handling appliances might well be given at this time. A relic of horse car traction is found in the walkaway plow, which is nothing more or less than a crude road machine drawn by horses, consisting of four wheels, a modified wagon frame and board. This machine proves valuable in leveling back drifts beyond the reach of electric snow plows.

The step from a walkaway to the leveler is but a short one, the leveler being merely a light flat car, drawn by power outside of itself, and having suspended under its body boards placed diagonally across the track.

Next in order comes the electric leveler, having its shares, or boards, placed diagonally under the body and between the wheels, the motive power being transmitted to the wheels through sprocket chains, from motors upon the car floor.

Following steam railroad practice, plows are also constructed with a board placed in front of the plow proper and diagonally across the track, so that the work of removing snow is done *in front of the car* instead of being done *under the car*, as by the above described levelers. The first of these plows were blunt affairs, ramming the snow and forcing it horizontally to one side. A modern plow of this type is more carefully designed, the share being so constructed as to first lift the snow, and then roll it over and over until it is clear of the track. This plow is further equipped with powerful flanges and easily controlled long wings or flukes.

Sweepers in various forms have been in use for years. Many roads still use the rattan sweeper, with its pair of brooms set diagonally across the track, and driven by a motor placed in the cab. These sweepers will remove the snow down to the pavement, if run early and often, but are slow, and fail entirely in a great quantity of rapidly falling wet or heavy snow.

Sweepers with steel instead of rattan brooms have been constructed and operated with some success. The advantage of this form of broom is found in its great strength and stiffness. The steel brushes will cut hard snow with great ease, do not bend, break or wear out rapidly. They are only stalled by drifts so high that the brooms cannot throw the snow out of the way. With them a drift may be bucked as successfully as with an ordinary share plow.

Six years ago the first *electric rotary snow plow* was put in operation. It was a crude affair, having for its cutting blades a segmental screw, whose front view gave the appearance of a propellor wheel, and back of which was placed an ordinary fan blower, with a suitable spout. A pair of light motors were mounted on the shaft in a small car, to rotate this screw. A passenger car was used to shove this appliance along, and at the end of the road a pin was pulled and the plow body rotated on its truck, so that the plow pointed in the opposite direction; the passenger car was then placed behind the plow, which proceeded on its journey.

In the following fall the writer built a modified form of this rotary snow plow (under contract with the patentee), having its truck equipped with motors, thereby doing away with the necessity of a pusher. The ease with which this appliance cut through huge drifts, depositing the snow at a distance from the track, led the Buffalo Railway and other companies to construct similar plows, making the plows two-ended; by means of suitably arranged clutches, the blades at either end of the plow may be cut in or out. The cutting blades are also arranged so that they can be given a lead or pitch in either direction, and be rotated right or left-handed. By this arrangement it is possible to always throw the snow in the most advantageous direction. The motor equipment on each plow consists of two 35-hp motors on the truck, and two 35-hp to 50-hp motors on the rotary shaft.

A modification of this rotary, intended to overcome inherent defects in the above described design, has been built at Charlotte. This plow has a twin screw, thereby getting the cutting blades down closer to the rails, and reducing the dead-snow load, which, in the former design, frequently stopped the travel of the plow.

The writer's experience has included work with all of the above described general types of plows and sweepers.

In the city of Buffalo, situated, as it is, at the foot of Lake Erie, subjected to high winds, and having at all times a more or less humid atmosphere, these plows, rotaries and sweepers are rated and berated by operatives about as follows:

The *walkaway* is invaluable in leveling back drifts at a distance from the track, opening up gutters and walks, and in performing similar work otherwise requiring manual labor.

The *leveler, or windsplitter*, as it is here called, has no excuse for existing, beyond that of furnishing something to run through the streets when all the plows are crippled and in the shop.

The *electric leveler* leaves a beautifully smooth street, cleans close to the rail, but is no good when snow falls 6 ins. an hour, for 6 ins. of ordinary snow stalls it, unless a pusher is used. It can seldom be operated during the day with less than five men, and usually requires six or eight.

The *share plow*, of light weight, requires a fairly good pavement and few hidden obstacles to operate without damage. It requires a pusher in heavy snow, leaves the track readily, lacks traction, and therefore fails in emergency.

The *heavy share plow*, with compression flangers, high-curved shares, long, heavy wings or flukes and powerful motors meets all city conditions well. It fails between high, frozen drifts close to the track, and in cuts on suburban lines, because it has then no place to shove the snow, and, when built for double track, unless weighing over 19 tons, is liable to shove off the track in a hard-packed drift.

The *rotary* is of value in keeping lines open during a heavy fall

of snow, through high snow drifts, and at times when all other plows fail.

It does not easily handle very wet snow, unless equipped with powerful motors. Its present design is faulty, but the faults might easily be overcome in new machines. In heavy work it must be moved slowly, with the fans rotating at very high velocity. It is an invaluable part of our snow plow equipment.

The *rattan sweeper* in this climate is too slow and expensive in maintenance. After trying one under varying conditions we have concluded that it is not for us, nor we for it.

The *steel broom sweeper* ranks next the rotary. It cannot work as well in deep drifts, but excels in hard packed or wet snow. It frightens horses, and, therefore, is not used during the day in the business districts of the city. When these steel-broom sweepers were built, *W. P. 50* motors were the latest type out. These plows have therefore been equipped with these motors, and as a result made frequent visits to the repair shop. Hereafter these sweepers will be equipped with *G. E. 1000* motors, and will be expected to give more reliable, if not more satisfactory, service.

Anticipating your question, the snow plow equipment of the International Traction Company's interests consisted last winter of: One McGuire sweeper, two T.H. steel broom sweepers, one single-end rotary, eight double-end rotaries, seven heavy share plows, Buffalo pattern; two Taunton share plows, one Brill share plow, sixteen electric levelers, ten trailer levelers, ten walkaways. This equipment operated over 190 miles of track in Buffalo, 18 miles in Niagara Falls, 5.50 miles in Lockport, 10 miles in Tonawanda, 56.50 miles of suburban and interburban track, a total of 280 miles of track.

The organization for the removal of snow and ice in Buffalo covered 190 miles of city track, and 30 miles of suburban track.

The Buffalo snow plow equipment consists of: Four rotary plows, three sweepers, fourteen electric levelers, ten share plows, seven trail levelers (in reserve), seven walkaways.

Giving an average of one snow plow for each 5 miles of track, or one heavy plow and one light plow for each 13 miles of track.

The superintendent was the head of the organization. The assistant superintendent and the assistant engineer of way acted as aids, each supervising the operation of one-half of the territory, which was further divided into twelve districts. Each district was under the personal supervision of an inspector. Each inspector controlled two or more snow plow crews, under a captain, and one or more gangs of shovelers, under a track foreman. The general track foreman had immediate charge of all shovelers, arranged their reliefs, furnished extra men and emergency aid of all kinds, and in all cases working with the district inspector.

By means of a private telephone exchange the two aids and the general track foreman, the superintendent kept in communication with the plows and men on each line. Inspectors reported by 'phone hourly, when possible, and in all cases kept the superintendent informed of their movements and the condition of their lines. The snow plow captains reported each time they passed a company telephone, and otherwise from a public telephone, in case of accident to their plows, or when in need of aid.

At the first sign of a storm all snow plow crews, track shovelers and switch cleaners reported at the designated headquarters of their district. The walkaways and teams, with sleighs, were subject to the call of the inspectors through the superintendent. They were sent to the various districts as required, the foreman of teams supplying from outside sources the additional teams and sleighs required, arrangements for which were made before the first snow fell.

The inspectors, upon approach of a severe snow storm, saw that the snow plow crews were on hand, and, if necessary, reduced the passenger car service to give the plows ample power and aid.

In case the snow plow equipment in a district was insufficient to insure the continuance of service on any line, aid was at once obtained from some neighboring district, instructions being transmitted by telephone or by one of the aids to the districts affected.

The aids and the general foreman were supplied with horses. During severe storms the instructors of motormen and conductors and clerks in the superintendent's office acted as special messengers, and when required, assisted the inspectors in operating the passenger cars, and acted as substitute inspectors while the inspectors were resting.

Last winter's severe storms proved a severe test of snow fighting appliances generally, and Buffalo's experience satisfied the management, as well as the operatives, that one-half the equipment was useless in emergency, and that the traction of all plows should be increased; that each type of heavy plow, sweeper or rotary has its place, and is of value to the company only when given the class of work for which it is designed.

London Letter

The royal assent having been given to the Houghton and Sunderland Electric Tramways bill, a start will be made at once with the preliminary work. The line will commence at Grangetown, on the southern boundary of Sunderland, and will pass through the populous colliery villages of Ryhope, Tunstall, New Silksworth, New Herrington, Philadelphia, Newbottle, Houghton-le-Spring, Hetton-le-Hole, and Easington-lane. There will also be branch lines, the total mileage being about 20, and the population of the district 60,000, exclusive of Sunderland. It is also proposed to extend the line to Workington and Usworth, affording communication with Newcastle. The overhead trolley system will be used, and it is proposed to carry goods by day and night in special trucks. The various local bodies in the district have given their sanction to the scheme, which has been promoted by the United Kingdom Tramways, Light Railway & Electrical Syndicate. The engineers for the scheme are D. Balfour & Son, civil engineers, and Handcock and Dykes, electrical engineers, both of Newcastle-on-Tyne and London. Major Tulloch, C. B., R. E., late chief engineer of the local government board, is chairman of the United Kingdom Tramways, Light Railway & Electrical Syndicate, the promoters of the scheme.

Some interesting figures are given in a paper recently read by Algernon H. Binyon, where it is stated the London tramways—horse and cable—carry 309,000,000 passengers, or 45 per cent of the total traffic; the underground railways 128,400,000, or 19 per cent of the total traffic; and the omnibuses 248,600,000, or 36 per cent of the total traffic. The whole population of London—5,500,000—travel 124 times in a year; while the New York population of 3,500,000, travel 210 times yearly.

The city of Leeds, which was one of the first cities in England to experiment with electric traction, is making distinct progress, and the tramways committee has recently decided upon a number of new routes, which it proposes the City Council should seek the necessary powers to construct in its bill to be promoted in the next session of Parliament. Leeds, like many other cities in England, is still using steam trams, and it is to be hoped that with the progressive spirit shown by the above, with its tramway committee under Mr. Smithson's excellent chairmanship, the electric trams will soon take their place. A steam tram can never be made pleasant traveling, and though the steam cars, both in Leeds and Bradford, are much superior to the ones in Birmingham, still in these days of electric transportation, we should soon see the last of them, and they will disappear without much regret.

Mr. Yerkes, the street railway magnate of Chicago, when in London in July, was impressed by the lack of traveling facilities between the northern and southern system of railways entering London, and returned to Chicago with a big scheme in his head. His plans are now set forth. Mr. Yerkes is said to have purchased the rights of the Charing Cross, Euston and Hampstead railway, and to have formed a syndicate, exclusively of American capitalists, to build an underground railway between these points, with an extension to Camden Town. The estimated cost of the undertaking is £2,400,000. There will be ten stations and four tracks—two for express and two for local trains—the motive power being, of course, electricity. The engineers for the railway are Sir Douglas Fox, president of the Institute of Civil Engineers, and William Robert Galbraith. In any case, such a road is badly wanted in London, as at present there is no good means of transportation between the three great northern termini, Euston, St. Pancras and King's Cross and the large railway terminus of Waterloo in the southern part of the city. The Baker Street & Waterloo Underground Railway, now under construction, would do much to help the situation, but still undoubtedly there is room for more, and in the present congested state of London streets, the underground electric railways are the natural solution of the difficulty.

So great has been the success of the "two-penny tube" that at certain hours the guards have had to prevent passengers getting in when others are getting out. The crowding is worse, of course, at the time when men and women are going to and returning from business. It is not surprising, therefore, that people are beginning to talk of another tube which will connect the city with the West End. The most crowded omnibus road in London is not that along Holborn, Oxford Street and Bayswater, but that from the Bank along Cheapside, Fleet Street, Strand and Piccadilly, and on to Hammersmith. In fact the part between the Bank and Charing Cross is at certain hours of the day almost impassable, owing to the congestion of traffic, it being no uncommon thing to take forty to forty-five minutes for the 2 miles journey on a bus. It will be over this route that the next tube, if ever constructed, will be carried. Such a line would be stoutly opposed by the Metropolitan and District companies, for it would prove a most formidable rival to that part of the underground system which runs close to the

Thames on to Victoria, Sloane Square and Kensington. The underground people have long been making experiments with the view of substituting electric for steam traction. The sooner they do something to improve the atmosphere of their tunnels and the comfort of their carriages the better, for though it may be a long time before we have a 2-penny tube between the Bank and Hammersmith we may have it some day, if the Metropolitan and District companies do not bestir themselves in earnest. Meantime the Central London is doing all it can to encourage patrons, and has built large bicycle sheds at its western terminus for passengers who live somewhere in the vicinity, bicycle to Shepherds Bush, and there for a moderate sum put up their bicycle till they return in the evening.

To find out just how far the omnibus companies have been affected by the establishment of the "2-penny tube," the *Financial News* publishes the following table of comparative traffic returns:

LONDON ROAD CAR

Aug. 9	£6,908,	against	last year,	£7,779
Aug. 16	6,260	"	"	7,644
Aug. 23	6,880	"	"	7,074
Aug. 30	6,381	"	"	7,132
Sept. 6	6,289	"	"	6,775

LONDON GENERAL OMNIBUS

Aug. 9	£22,629,	against	last year,	£24,490
Aug. 16	20,737	"	"	24,030
Aug. 23	23,055	"	"	22,506
Aug. 30	21,405	"	"	22,871
Sept. 6	21,119	"	"	21,856

The English Lake district has been threatened with electric tramways, and the scheme has called forth a large amount of correspondence on the subject, the preponderating opinion evidently being in favor of leaving this most beautiful country free from such desecration. Public meetings have been held, and it now appears that the garden spot of all England will escape. We do not hold that the judicious installation of tramways would utterly spoil the scenery, but still perhaps it is just as well to have a few places on earth where the mechanical modes of transportation do not penetrate, and where nature may hold sway undisturbed. H. D. Rawnsley, honorary secretary of the "National Trust for Places of Historic Interest or Natural Beauty," in concluding a letter to the *Times* on the subject, says:

"The Bowness Urban District Council, it is true, has at a small meeting of its members by a majority of 1—I believe this was a casting vote—expressed itself in favor of the undertaking. The Ambleside Urban District Council has not yet expressed itself definitely for or against; but from all sides one hears expressions of regret that a great London company, in conjunction with a local electric lighting company, should have determined to exploit the English Lake District for its own selfish ends and to disfigure forever one of the most beautiful roads we have in Westmorland. More and more it looks as if some nationalization of this little 20 miles square of undisturbed recreation ground would be the only means of keeping it for the best use and enjoyment of future Britain."

A new electric tramway route at Bradford has been opened for traffic. The length of the route is 2837 yards, consisting of 2007 yards of double line and 830 yards of single line. As in the other Bradford tramways, the narrow gage—a width of 4 ft.—has unfortunately been adopted, with an interspace between the double lines of 4 ft., 3 ins. The average gradient is 1 in 37, and the steepest parts have a gradient of 1 in 17.46 for a distance of 75 yards, and 1 in 18.48 for a distance of 175 yards. The tramway is paved with granite setts, 6 ins. x 3 ins., on a concrete foundation 6 ins. thick, composed of one part of cement and eight parts of broken stone and clinker. The setts are grouted in pitch. The line is worked by electric motors, supplied by Witting Bros., Ltd., of London, and the car bodies by the Brush Electric Company, of Loughborough. The steel rails are of the trough type, 5 ins. deep, and they weigh 70½ lbs. to the yard. They are packed with concrete, consisting of one part of cement to four parts of granite shingle, and have been supplied by Demerbe & Company, of Belgium, who are also the contractors for the points and crossings. The total length of the tramway now laid in Bradford is 40 miles 694 yards, when reduced to single line. The whole of the overhead work is being done by Macartney & McElroy, of London, who have recently received orders for some very large extensions. This enterprising firm, who have the entire overhead construction work of Glasgow and Aberdeen in hand, have also received the contract for the overhead equipment of Manchester.

Leonard W. Holmes and E. H. Johnson, of the Johnson-Lundell Electric Traction Company, Ltd., who have but recently returned from the Continent, where they secured some good orders, and entered into most satisfactory negotiations for the disposal of Continental patents, have sailed for the United States, where they will stay for about a month. Among other things which they contemplate doing, they will arrange for the prompt manufacture of the Lundell street car motor, as they have not yet got facilities enough in England for that purpose, though the generators will be continued to be made in England. Many of Mr. Johnson's old friends will be delighted to see him again, and we feel sure that Mr. Holmes will also receive a cordial welcome, and will, in the short time which he will reside in the States, make many pleasant acquaintances.

The Worthington Pumping Engine Company, London, has just issued an interesting pamphlet in French and English descriptive of its magnificent exhibit at the Paris Exposition. The first page gives a plan of the Exposition, showing where each Worthington pump is installed, a large number of them being used for the Chateau d'Eau at one end of the Champ de Mars, where the crowds are never tired of looking at the beautiful cascade and fountains. The whole comprises the largest exhibit of pumping machinery ever exhibited. The exterior and the interior of the Pavilion Worthington are also illustrated, in which were situated four Worthington triple-expansion, high-duty, pumping engines, having a capacity of 40,000,000 imperial gallons per day. The equipment of the Eiffel Tower is also described, and the various exhibits in the Machinery Hall. The pamphlet is profusely illustrated with cuts of the various types of Worthington pumps, and is well worth having in one's possession. A. C. S.

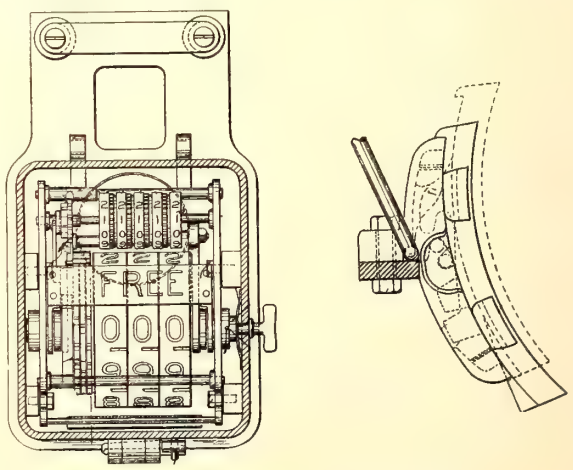
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

ELECTRIC RAILWAY PATENTS ISSUED OCT. 2, 1900

658,816. Protecting Apparatus for Tramway Cars or Similar Vehicles; A. Thiels, Hamburg, Germany. App. filed Nov. 21, 1899. Consists of a scoop composed of a series of independent bars held normally elevated by a latch common to all the bars, and an arrangement of levers to release the bars by contact with an obstruction.

658,854. Car Fender; H. Lutzenkirchen, Hartford, Conn. App. filed Feb. 14, 1900. The fender has a part that is automatically thrust forward to catch and retain a body that falls upon the fender, it being operated by the weight of the body and not by contact therewith.



PATENTS NOS. 659,421 AND 659,629

658,856. Brake Shoe; T. W. Mitchell, South Omaha, Neb. App. filed Feb. 28, 1900. Embodies a plurality of removable wear blocks arranged longitudinally and adapted to co-operate with different portions of the surface of the wheel in order that the wear may be equalized.

658,864. Step-Over Car Seat; C. K. Pickles, St. Louis, Mo. App. filed July 22, 1898. Relates to a construction whereby the shifting of the back will also shift to tilt the seat slightly, the back-supporting arms lying wholly below the seat and out of the way of the occupant.

658,932. Metallic Railway Tie; O. Vill, Minnesota, Minn. App. filed Feb. 15, 1900. Structural details which provide for locking the rail to the tie and preventing shifting or creeping of the tie.

658,949. Car Seat; P. M. Kling, St. Louis, Mo. App. filed Feb. 28, 1898. Similar to patent No. 658,864.

658,950. Car Seat; P. M. Kling, St. Louis, Mo. App. filed March 30, 1900. Relates to reversible car seats. In this case the

back can be changed from one side to the other by swinging it around the seat in the arc of a circle in a horizontal plane.

658,951. Seat; P. M. Kling, St. Louis, Mo. App. filed March 30, 1900. Relates to seats intended for out-door or summer car use, when the seat is liable to become wet. By shifting the back from one side to the other the seat will be turned over or reversed.

658,964. Rail Joint; W. F. Sellers, Gallitzan, Pa. App. filed May 23, 1900. Comprises a chair having a fixed longitudinal fish-plate, an opposite hinged fish-plate and a wedge driven transversely between the hinged plate and the chair, the wedge forming a lock for the hinged plate.

658,972. Brake Beam; F. B. Alger, St. Louis, Mo. App. filed April 9, 1900. Structural details.

ELECTRIC RAILWAY PATENTS ISSUED OCT. 9, 1900

659,220. Convertible Street Car; G. N. Fillis, Canton, Ohio. App. filed Jan. 11, 1900. The sides of the car are provided with hinged bodies which form the side step when the car is open, but which, when turned up, afford tracks or guide ways for the sliding sections which are used to close the car.

659,257. Railway Rail Fastening and Brace; J. N. Powell, Wichita, Kan. App. filed April 4, 1898. Details.

659,294. Track Clearer; M. B. Eaton, Boston, Mass. App. filed Dec. 14, 1899. Designed to clear the rail by throwing what there may be on the rail in front of the moving clearer ouside the track, and by throwing any object which may fall immediately upon the track after the front moldboard of the clearer has passed toward the opposite rail.

659,325. Switch-Turning Mechanism; W. L. Sellers, Pittsburgh, Pa. App. filed April 12, 1900. A mechanical arrangement of specific construction for operating switch tongues by levers carried on the car.

659,408. Track Cleaner and Oiling Device; W. Morck, P. Krickau and W. Boehle, Oakland, Cal. App. filed March 13, 1900. Provides for connection between an adjustable track clearer which is carried upon the car truck, and the car body, which is movable transversely independent of the truck.

659,421. Registrating Machine; J. Schinneller, Pittsburgh, Pa. App. filed Oct. 7, 1899. When used on cars is designed to secure the registration of every fare by making such registration of possible pecuniary advantage to the passengers. At irregular intervals in the operation of the device, instead of registering a number it will display a sign; for instance, the word "free" indicating that a fare is to be returned.

659,454. Switch-Operating Mechanism; F. A. Tuff, Detroit, Mich. App. filed Nov. 22, 1898. Relates to that class of electric railway switches in which the operating circuit is cleared through an insulated section of the trolley conductor and the motor circuit on the car, the invention lying chiefly in the details of construction of the insulated section.

650,517. Hydraulic Brake for Railway or Tramway Vehicles; C. Durey, Paris, France. App. filed Nov. 9, 1899. Employs a liquid pump having a piston constantly acting when vehicle is in motion, and valves controlled by a switch for making the liquid flow effective or non-effective in applying the brakes.

659,573. Apparatus for Lifting and Gripping Ropes, Cables or Chains of Rope or Similar Railways; W. P. Bullivant, London, England. According to this invention the locomotive or other vehicle is provided with two manually operated devices for lighting the cable, and between these a cable-gripper operated by steam is located.

659,629. Automatic Brake Block; W. H. Sauvage, Denver, Col. App. filed Feb. 5, 1900. The brake-shoe lies loosely in its support so that when the beam carries the same against tread of wheel the friction will cause shoe to move upwardly. This produces a wedging action which is utilized to brake the wheel.

PERSONAL MENTION

MR. E. A. WURSTER, secretary of the Falk Company of Milwaukee, sailed for Europe Oct. 6 on a three months' pleasure trip.

MR. CHARLES G. WINGATE, formerly superintendent of construction for the Long Island Railroad, has just been appointed division superintendent of the elevated division of the Brooklyn Heights Railroad.

MR. HENRY G. ISSERTEL has recently become connected with the Sprague Electric Company, and will devote his time principally to the split-pole machines which the company is now manufacturing. Mr. Issertel is well known in the street railway field, having been one of the early pioneers in electric railroading with the Thomson-Houston Company, and later having been prominently identified with the Walker Company.

MR. E. M. BUSHNELL, formerly vice-president and manager of the United States Supply Company, of New York, died of typhoid fever at his home in Flatbush, L. I., Sept. 24, after an illness of but a few days.

MR. D. F. CARVER, who was for many years connected with the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., as engineer in charge of buildings, has severed his connection with that company to accept the position of chief engineer of the Cleveland Electric Railway.

MR. RICHARD D. BLACK, a prominent attorney, electric railway promoter and stockholder of the Indianapolis & Greenfield Electric Railway Company, of Indianapolis, Ind., was accidentally killed in Indianapolis a few days ago. He attempted to board one of the cars of the company from the wrong side and was crushed to death by coming in contact with a central pole.

MR. H. S. COOPER, formerly general manager of the Ithaca Street Railway Company, has opened an office at 290 Broadway, New York City, and will engage in the business of reconstructing and developing unprofitable street railway systems. Mr. Cooper's ability as a practical street railway manager is well recognized, and having had a long experience in different parts of the country, he is well able to carry out the work which he is undertaking. He has issued a circular calling attention to his new plan, and there is no doubt but that he can suggest many practical economies which may often make a striking difference in the net earnings of a property.

MR. EDWARD C. SPRING, who has recently been appointed superintendent of the Newton & Boston Street Railway and the Wellesley & Boston Street Railway, to succeed Mr. L. H. McLain, was born in Boston in 1863. He attended the public schools of that city, and fourteen years ago entered the electrical department of the Thomson-Houston Company at Lynn, Mass., where he remained for a long time. He was later appointed assistant superintendent of the Norfolk Suburban Street Railway Company, which position he resigned to accept the superintendency of the Norfolk Western Street Railway and the Medfield & Medway Street Railway. Mr. Spring has made countless numbers of friends during his connection with the electrical industry, and has always been held in high esteem by his employees. When he severed his connections with the Norfolk & Western Street Railway and the Medfield & Medway Street Railway he was presented with a handsome gold watch by the employees.

EDWARD C. SPRING

MR. A. H. WOLCOTT, formerly superintendent of the South Shore & Boston Street Railway Company, has been transferred to the Quincy division of the Brockton Street Railway Company. Mr. Wolcott started railroading with the Lynn & Boston Railroad Company. From there he went to the Quincy & Boston Street Railroad Company, where he was employed for some time under Superintendent Benjamin J. Weeks, whom he now succeeds. Seven years ago he accepted the position of superintendent of the Rockland & Abington Street Railway Company, and, when that road became part of the South Shore & Boston Street Railway system, he was made superintendent of the entire sytem.

MR. BRET HARTER has just been appointed mechanical and electric engineer of the Detroit, Rochester, Romeo & Lake Orion Railway, of Detroit, Mich., and of the other roads built and projected by the Winter, Law & Andrews syndicate. Mr. Harter was formerly superintendent of the Detroit, Rochester, Romeo & Lake Orion Railway. He will have charge of the design and construction of the power house, and the high-tension transmission line which will be built for the Grand Rapids & Holland Electric Railway, which company has absorbed the Holland & Lake Michigan Railway, and also the Saugatuck, Douglas & Lake Shore Railway, making a system of some 50 miles. The Detroit, Rochester, Romeo & Lake Orion Railway has now in hand the erection of a high-tension transmission line, and sub-stations on its extension from Rochester to Oxford and Flint.

MR. FRED. L. BLOSS, who was at one time assistant electrician of the Metropolitan Street Railway Company, of Kansas City, Mo., and who was also prominent in electrical enterprises in the West, died at his home in Kansas City Oct. 2. Mr. Bloss was twenty-eight years of age. He was born in Potsdam, N. Y., June 4, 1872, and received his early education at Montreal, Can. He graduated from the Kansas City high school, and then took a course in electricity at the Kansas State University. After completing this course he entered the employ of the Thomson-Houston Company and later the General Electric Company. In 1893 he became connected with the local lighting company at Kansas City, and entered the employ of the Metropolitan Street Railway Company of that city two years later. The Kansas City & Independence dummy line and Northeast and Brooklyn Avenue cable lines were converted into electric lines under his supervision. He is survived by a wife and one child.

MR. LLEWELLYN H. McLAIN, of Newton, Mass., has recenly been appointed an inspector of railways by the Board of Railroad Commissioners of Massachusetts. Mr. McLain is a practical street railway man, and is well versed in street railroading. Having started as a street car driver, his experience has been very broad, and he is well qualified to fill the important position in which he has been placed. Heretofore there have been only three inspectors, but the rapid increase in the mileage of electric lines has been so great during the past few years that it has been found necessary to appoint an additional inspector at this time, as provided under the law of 1894. The board now proposes to make a more thorough and systematic inspection of the street railway lines than has been possible in the past with only three inspectors. Mr. McLain was born in Hope, Maine, in 1861, and was educated in the public schools of that State. Coming to Boston when quite a young man, he entered the service of the Metropolitan as a driver in 1881, and after the organization of the West End Street Railway worked in several of the divisions. In 1890 he left the employ of the West End Street Railway Company and accepted a position as a driver on the Newton Street Railway, which was one of the first electric roads in Massachusetts. Two years later he had charge of the construction work during the building of the Newton & Boston Street Railway, and in 1894 he was appointed superintendent of the road, as well as superintendent of the Wellesley & Boston Street Railway, which position he resigned Oct. 1 to accept the position tendered by the Railroad Commissioners. He was also, for some time, superintendent of the Commonwealth Avenue Street Railway Company, of Newton. He has always been held in high esteem by his employees, and was presented with a handsome silver service when he severed his connections with the Newton & Boston Street Railway and Wellesley & Boston Street Railway. Mr. McLain is vice-president of the New England Street Railway Club.

LLEWELLYN H. McLAIN

ENGINEERING SOCIETIES

BROOKLYN ENGINEERS CLUB.—At the regular meeting of this club, Oct. 11, Mr. Frank C. Cudworth presented a paper entitled "The Electric Conduit Railway: Its Development and Construction."

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the regular meeting of this society, held Wednesday, Oct. 17, 1900, the paper entitled "The Preservation of Railway Ties in Europe," by Otave Chanute, was presented for discussion.

NEWS NOTES

PINE BLUFF, ARK.—J. B. Bradley, of Chicago, has become associated with W. H. Keyser, who projects the construction of a street railway and lighting system here, and both gentlemen were here a few days ago looking over the ground and laying plans. Mr. Keyser has recently been granted an extension of three months in which to begin the construction of the line under the original franchise grant.

BAKERSFIELD, CAL.—The Mountain Valley & Bakersfield Railroad Company has made application for a franchise here. The company contemplates the construction of an electric railway from this city to the South Fork country.

BRISTOL, CONN.—The Bristol & Plainville Tramway Company has made application to the Borough authorities for permission to build an electric line from Bristol to Terryville. The company has also made application to the Selectmen for permission to build from the borough line to the town line of Plymouth, and application will also be made to the Selectmen of Plymouth for similar privileges.

CHICAGO, ILL.—The Street Railway Commission has received an offer from a syndicate of a 3-cent fare in exchange for a blanket franchise covering the territory occupied in this city by the Chicago City Railroad Company and the Union Traction Company.

CHICAGO, ILL.—Nine persons were injured in a grade crossing collision between a car of the Calumet Electric Street Railway and a suburban passenger train on the Lake Shore & Michigan Southern Railway at Stony Island Avenue and Seventy-Ninth Street, Oct. 8.

EAST ST. LOUIS, ILL.—The strike on the Collinsville, Caseyville & East St. Louis Electric Railway was declared off Oct. 2.

CHICAGO, ILL.—The Citizens' Street Railway Association has made application to the Secretary of State for a charter. The object of the company is to construct street railway lines to be capitalized at the actual cost of constructing the line, on which the fare is to be 4 cents. The plan of the company is to sell out to the city at the actual cost of construction at any time the municipality may see fit to purchase it. It is proposed to construct an experimental line between Twenty-Second Street and Lincoln Park, Chicago, a distance of 4 miles. The incorporators of the company are Charles L. Bonney, Lyman M. Paine and Emil A. Basener, of Chicago.

LAFAYETTE, IND.—An electric railway is projected to extend from this place through the corn belt region to Veedersburg.

INDIANAPOLIS, IND.—The Board of Public Works has ordered the Indianapolis Street Railway Company to change its system of overhead feed wires and place them under ground in the downtown districts.

WABASH, IND.—The right of way has at last been secured for the proposed electric railway between Wabash and Peru, and it is announced that Eastern capitalists are to furnish the funds for constructing the line. Frederick C. Boyd is largely interested in the project.

KEOKUK, IA.—The Keokuk Electric Railway & Power Company has filed amended articles of incorporation with the Secretary of State of Iowa. The company is empowered to construct electric railway lines, do a general electric lighting business, furnish heat and power and maintain and operate steam heating, hot water heating, gas and telephone systems in and near Keokuk.

SIOUX CITY, IA.—The Benevolent Order of Street Railway Employees of Sioux City is the name of a new organization formed here recently. The society has been organized for the mutual protection and benefit of its members, who are all employees of the Sioux City Traction Company. The officers are: Frank Lovell, president; William Glenn, vice-president; N. J. Lucian, secretary; J. V. Gibbons, treasurer. These officers, together with George Dunham, George Llewellyn and Andrew Anderson, constitute the board of directors.

WICHITA, KAN.—A car of the Wichita Railway & Light Company jumped the track Sept. 30, plunging into Chisholm Creek. About thirty persons were injured.

WATERVILLE, MAINE.—The Franklin, Somerset & Kennebec Railroad Company has petitioned the Railroad Commissioners for approval of highway crossings, and crossing the Somerset Railway and the Maine Central Railroad, on its line to Watervillle. This road is partly constructed toward Sharon, and this petition indicates that the company contemplates building to Waterville.

AUGUSTA, MAINE.—The Gardiner Street Railway Company has again petitioned the Railroad Commissioners for approval of articles of association for a new route, which it is supposed will do away with the opposition of the Maine Central Railroad Company, through whose objections its former applications were rejected. The new line will not parallel the Maine Central Railroad, as the layouts in the former applications did. The new line will be 10 miles in length, and the capital stock is to be $45,000. The directors are: B. M. Turner, John K. Foy and Ammi Davenport, of Gardiner.

ELKTON, MD.—The City Council has passed an ordinance granting the Elkton & Chesapeake City Electric Railway Company a franchise for the construction of an electric railway here, and also for the operation of an electric lighting plant.

MILFORD, MASS.—Five persons were injured here a few days ago in a head-on collision between a passenger and repair car of the Milford, Hollliston & Framingham Street Railway Company. Both cars were derailed and badly damaged.

HOLYOKE, MASS.—The Summit House, owned by the Mount Tom Railroad, was destroyed by fire Oct. 8. The loss is estimated at $25,000.

BOSTON, MASS.—The Boston Elevated Railway Company has placed an order with the Sprague Electric Company for one hundred equipments, instead of sixty, as generally reported.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company has voted to call an assessment of 20 per cent on the stock. The directors have decided to accept the franchises granted the company in Hopedale, Mendon and Uxbridge, and will probably have the line in operation early next spring.

TAUNTON, MASS.—The Railroad Commissioners have granted the Brockton Street Railway Company permission to operate over the lines of the Taunton Street Railway Company in this city.

STREET RAILWAY JOURNAL

WEEKLY NEWS ISSUE

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week, in order to secure insertion in the current issue.

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The Convention Report

Following our usual custom, a complete report of the convention of the American Street Railway Association, held last week, will be published in our November issue, published the first Saturday in November. This issue will contain all the papers presented at Kansas City, also a verbatim report of the proceedings of the American Street Railway Association, comments on the Accountants' and American Street Railway papers at the convention, a full report, with engravings, of the exhibits, a list of the delegates in attendance, etc.

N. Y., N. H. & H. R. R. to Extend Third-Rail System

President Hall, of the New York, New Haven & Hartford Railroad, announces the success of the third-rail system between Hartford and Bristol, Conn., and states that it will be extended to Waterbury in a few months.

New Interests in B. R. T.

The New York *Times* is authority for the statement that a majority of the capital stock of the Brooklyn Rapid Transit Company has been bought by Metropolitan Street Railway interests, and that new directors are to be elected. Messrs. Whitney, Elkins, Widener and Rockefeller are said to be the ones who will represent the new interests, and it is even intimated that they will enter the directorate of the company.

New England Steam Roads to Build Trolley Lines

The directors of the Boston & Maine Railroad and the directors of the Concord & Montreal Railroad have voted to build a branch electric railway from Concord through Pembroke, Suncook, Allenstown, Hooksett, Manchester, Goff's Falls and Litchfield to Hudson, connecting with the Nashua Street Railway at Lowell Street in Hudson and the Concord Street Railway at Pleasant Street in Concord. The road is to be built under the provisions of the Concord & Montreal Railroad lease to the Boston & Maine Railroad and the general laws of the State of New Hampshire. The Concord & Montreal Railroad has filed a petition asking for permission to construct the proposed line.

Conductors Not Required to Change Bills Larger than Five Dollars in Seattle

Judge Jacobs, of Seattle, Wash., has just handed down a decision which says that a street car conductor cannot be required to change a bill or other negotiable note of more than $5. The decision upholds the company in a suit brought by a passenger because he was ejected from a car after tendering a $10 bill in payment of his fare. The conductor told the passenger that he could not change the bill, and that he could not be required to change a larger piece of money than $5. He said that these were the rules of the road, and insisted that he should leave the car if he could not comply with the company's rules. This the passenger refused to do, and it was found necessary to eject him.

The Birmingham Consolidation

At a meeting of the stockholders of the Birmingham Railway & Electric Company, of Birmingham, Ala., held Oct. 17, the consolidation of the properties of the company with the recently acquired street railway lines was accomplished. The new properties were the Birmingham Traction Company and the Powderly line. The name of the consolidated company is the Birmingham Railway, Light & Power Company. The capital stock remains as it was in the old company, $1,250,000. There are $1,500,000 bonds of the Birmingham Railway & Electric Company, and $500,000 of the Birmingham Traction Company. It has been agreed to issue $3,500,000 of bonds on Jan. 1 next. Of the new bonds $1,750,000 will be placed in the hands of trustees, to offset those already issued on the two companies. The remaining capital will be used in making extensive improvements. There is no change in the officials of the company. A blanket franchise, covering all the lines at Birmingham, was secured a few weeks ago.

Mr. Yerkes Returns

Having successfully completed the last details in connection with the purchase of the Charing Cross, Euston & Hampstead Railroad Company, Mr. Yerkes has returned to America. As previously announced in the STREET RAILWAY JOURNAL, the purchase secures for Mr. Yerkes the charter, which grants right of

way, etc., no work having ever been done on the line. Before leaving London, Mr. Yerkes announced his plans regarding the project as follows: "We shall build the line from Charing Cross to Hampstead, with connections to Euston, Paddington, and perhaps Victoria. The construction and equipment will be of the same general design as that of the Central London Railway. There will also be a connecting station with the latter line. But in doing this we provide only what we hope will prove to be the trunk line of a system of suburban rapid transit. The chief desire is to bring a large territory north of London within easy residential distance of London workers of all classes. To accomplish this we shall seek to provide surface electric lines radiating in all directions from our northern terminus as a common center. It is this plan which has been the main feature and the most successful one of our Chicago system. We opened up the prairie for 40 miles around Chicago by this means. The same system of rapid transit would do for London or for any other congested city all that it has done for Chicago. No, I do not contemplate doing for South London or the East End what we are about to undertake toward the north. One enterprise of this magnitude is sufficient. If it succeeds, the demonstration will speedily bear fruit and similar facilities will be provided for other quarters of the metropolis."

Light Railways and Electric Railways in Italy

A recent report of the Italian Inspector-General of Railways gives a list of tramways operated in Italy by mechanical power, the aggregate length of the lines on Jan. 1, 1900, being 1830 miles (3179 km.). By governmental regulation the term "tramway" is applied to all lines installed on streets and highways, and thus includes short lines of steam road, which ordinarily would be termed light railways. We consequently find that the greater part of the mileage quoted consists of lines operated by steam power, the aggregate length of electric roads being only 147 miles (246 km.).

The first light railway was installed in 1878, between Coni and Borgo San Dalmazzo, the length being 418 miles (8 km.). The following year a line 39 miles long (65 km.) was authorized to be laid between Bari and Barletta, but it was not until after 1880 that the development gathered strength.

Four-fifths of the mileage now operated lies in the three provinces of Lombardy, Piedmont and Emilie. A number of provinces have no railways of the class considered, and Sicily and Sardinia have each only one line.

The electric roads, with a few exceptions, are confined to urban lines in Turin, Milan, Genoa, Rome, Florence, Leghorn and Palermo. Turin comes first on the list, with 30 miles of road (50.3 km.), and Milan second, with 29 miles (48.4 km.). The maximum speed of electric traction is fixed at 7 miles to 10 miles per hour, and that of the steam tramways at from 11 miles to 12 miles, though in several instances a higher speed has been allowed, the maximum being 17 miles.

There are numerous projects for the installation of new electric lines, and for the displacement of steam by electricity on light railways. In view of the abundant water powers of the Italian peninsula, and the apparent readiness with which capital has been secured to carry out some of the plans for the operation of northern Italian railroads by electrical energy transmitted from hydraulic generating plants, it appears quite probable that Italy is on the eve of a considerable development in electric traction.

Two Meetings of the New England Street Railway Club

At the regular meetings of the New England Street Railway Club, held at the Pathfinder Meeting Rooms, 67 Federal Street, Boston, on Sept. 19 and Oct. 17, the subject of snow plows and how to keep the tracks clear during heavy snow storms was discussed. At the opening of the discussion on Sept. 19 the secretary read a letter from Arthur W. Field, the New England representative of the Peckham Motor Truck & Wheel Company, who had been invited to be present, to explain the merits of the Ruggles rotary snow plow, which is manufactured by the Peckham Company. Mr. Field stated in his letter that the rotary snow plow was designed for heavy snows, and to be used as an auxiliary to the horse or push plows.

After the letter was read, the president asked if any superintendent was present that had any experience with the rotary plow, if so the members would like to hear from him.

Mr. Wolcott, of the South Shore & Boston Street Railway Company, gave a very interesting account of the results obtained by his company through the use of this type of plow, his remarks being summed up as follows: He began to look up rotary snow plows about two years ago, but it being quite near spring, the subject was side-tracked. The next summer his company bought two of these rotary plows. Last winter was a very open one, there being but one severe storm, and there was but little chance to make a fair test of this new equipment. After this storm the company had from 70 miles to 75 miles of track to open, of which some 30 miles were left tied up. On the following morning were started the two rotary plows to work, and in five hours the line was open and the cars running. The company left a mile closed for experimental purposes, and the next day worked a little while on it, and so on for three days before this mile was opened. Every day the snow thawed, while the teams kept driving over it; it kept getting harder and harder, but no trouble was found in taking it out with the rotary plow.

In answer to a question, Mr. Wolcott said that by the adjustment of the wings it is possible to throw the snow on either side of the street, or anywhere they might wish to put it, from 3 ft. to 20 ft. from the rail. No trouble was experienced in heavy snow banks. One heavy drift was about 8 ft. high on the track, and 10 ft. on one side, and about 150 ft. long, and it took but ten minutes to go through it. The plows made an average of from 4 miles to 5 miles an hour through 3 ft. to 4 ft. of snow. The day after the storm the Selectmen came down to break the street through for teams, and wanted to know what the company had done with the snow. Mr. Wolcott said that one rotary snow plow to 25 miles of track in a suburban district would keep the road open. Mr. Wolcott replied to several questions relative to the subject, and his remarks were received with great satisfaction by those present who had never seen one of the plows working.

A vote of thanks was tendered the Rand Avery Supply Company for the use of its rooms for the meeting, and for other courtesies extended to the club.

The meeting was adjourned until Oct. 17, when it was announced that lunch would be served after adjournment, and the subject of other types of snow plows would be discussed.

MEETING ON OCT. 17

The meeting of the club on Oct. 17 was the most successful held. Forty-eight superintendents and others interested in street railways were present. The meeting was called to order by the president, who made a few remarks regarding the large attendance, after which the records of the previous meetings were read by the secretary and approved.

The president then introduced E. C. Spring, superintendent of the Newton & Boston Street Railway, who had been asked to open the discussion on plows. Mr. Spring said that he firmly believed that there was a diversity of opinion among the street railway men as to the best method of handling snow. In this matter local conditions play a most important part. It was clearly shown at the last meeting that on suburban roads the rotary snow plow works very satisfactory, while in the crowded section of a city the nose or shear plow is the best. He continued:

"I am sure that if any superintendent intends to purchase a snow plow or sweeper, it would pay him well to study carefully the articles that have appeared in the Street Railway Journal and the *Street Railway Review* from time to time during the past nine years. These articles not only show how the different companies handle snow in various parts of the country, but they give the opinion of the operating managers in many cases as to the plow or sweeper best adapted to their road; many of the roads building a plow of their own. I believe that it would be an excellent idea for the club to make a digest of these articles and other information that can be obtained on the subject for the benefit of the superintendents of New England who cannot afford the time to look up themselves the valuable information that is contained in these articles. This is where our club can be of assistance to its members.

"I have made up the following schedule from letters received from the different New England street railway companies in regard to the manner in which they handle snow:

"The Southbridge & Sturbridge Street Railway Company has 8 miles of track, very heavy grades, and two single-truck plows. These plows are equipped with salt and sand boxes, as are the cars. As soon as the snow begins to fall heavily the company applies a mixture of salt and sand, then follows this up with the plows, men being stationed at heavy drifts to shovel away the banks. The company has also a car follow the plow. Practically the entire system is on the side of the street. The cars are also equipped with track cleaners, which are found of great service in snow storms.

"The Torrington & Winchester Street Railway Company, of Connecticut, has 11 miles of track of which 2-5 are located on the side of the street with a maximum grade of 8 per cent. The com-

pany has two plows, which are kept going during a storm with good results.

"The Meriden, Southington & Compounce Tramway Company, of Meriden, Conn., has 15 miles of track, which lie through an open country, where heavy drifts are frequent during a storm. This company has only one plow.

"Mr. Ogden, of the Worcester & Clinton Street Railway, has 20 miles of track under his charge. This certainly must be a hard road to keep open during the winer, as it stretches for some distance along the Wachusetts Water Basin, with no protection from the wind. He states that he has three plows and one sweeper, but he suggests that an improvement could be made on the nose of the plows, which would lift the snow and throw it away in the manner of the plows attached to steam engines.

"The Milford, Holliston & Framingham Street Railway Company operates 22 miles of track, and has three plows in service. About three-quarters of this system is on the side of the street, with very heavy grades. During a snow storm salt and sand are distributed by the plows with very satisfactory results.

"The Norwalk Tramway Company, South Norwalk, Conn.: Mr. Mansfield states that they have two heavy nose plows of their own make, and two nose plows which are attached to the front of the regular cars. They have 20 miles of track, with from 8 per cent to 10 per cent grades. In snow storms they first use horse levelers to keep the banks fully 10 ft. from the track, and then follow up with the plows. Mr. Mansfield states that they have very little snow along the Sound on account of being so near the salt water, and he has known cases where it has frequently snowed hard 5 miles inland, or north, while it has rained in Norwalk.

"The Sanford & Cape Porpoise Railway Company, Sanford, Maine, has 23 miles of track, all of which practically is located on the side of the road. This company has two plows, and a heavy freight locomotive, with ordinary locomotive steel nose. This locomotive has four 38 B Westinghouse motors, and does the most satisfactory work in snow of anything with which the company is acquainted.

"The Meriden Electric Railroad Company, of Connecticut, has 19 miles of track, with varying grades. The snow equipment consists of two nose plows, one shear plow and one sweeper; the shear plow is used for double track, and the nose plow for single track. Mr. Bristol, the superintendent, says that a plow should be designed to suit the local conditions. An independent salt and sand car is run continuously during a snow storm.

"The Lexington & Boston Street Railway Company has not yet experienced any storms, as this line was not in operation last winter, but it has already purchased four plows to take care of 25 miles of road. Mr. Greene, its superintendent, believes in starting the plows with the commencement of the storm, and to keep them, as well as the cars, running if sufficient power is available. He also believes in running an independent sand and salt car.

"The Norwich and the Montville Street Railway, of Norwich, Conn., has four nose, one shear and one rotary plow. Out of the 28 miles of track 24 miles are located on the side of the street. In some places the grades are as heavy as 12 per cent, and the average is 8 per cent. The company considers the shear plow in light snow, and the nose in heavy snow best adapted for the work. All the cars have sand boxes. The company does all its salting, except at switches, from plows.

"The South Shore & Boston Street Railway Company has 70 miles of track, of which 90 per cent is on the side of the street, with a few heavy grades. It has nine nose plows and two rotary. Mr. Wells, the general manager, states that the company spares no expense in keeping the tracks clear during a storm, if possible. In the worst places sand and salt are used.

"The Interstate Consolidated Street Railway Company operates 26 miles of track, two-thirds of which are located on the side of the street, with moderate grades. The company has five single plows, and one four-motor plow.

"The Leominster & Clinton, the Fitchburg & Suburban, the Worcester & Clinton and the Clinton & Hudson have 38 miles of mostly side construction, four plows and one sweeper. Sand and salt are used in the worst places. The manager depends on his nose plows for severe work. The average grade is 7 per cent, but there is one point on the Fitchburg Suburban, where the grade is 13 per cent for 600 ft. This is kept clear by shoveling. The company believes in starting its plows promptly and keeping up with the storm."

The following articles have appeared in the STREET RAILWAY JOURNAL and the *Street Railway Review* since 1892, in reference to the handling of snow, and the make and type of plows and sweepers used:

[STREET RAILWAY JOURNAL]

October, 1892, and August, 1894.—Electric sweepers built by the Brooklyn Railway Supply Company, of Stamford, Conn.

April, 1892.—A good account of a heavy snow storm at Quincy, Mass., which commenced March 1, and lasted until March 4. The article is illustrated.

March, 1892.—An article as to how the Ottawa Electric Railway Company handles snow storms.

January, 1892.—An article showing a plow that can be attached to any car, made by the Wales Manufacturing Company, of Syracuse, N.Y. There are no wheels on the plow, but the forepart rests upon the rail by means of a heavy half-round shoe or boiler plate, which slides along the rail and allows the plow to pass over frogs, switches, crossings, etc.

February, 1894.—"A Model Snow Plow."

April, 1894.—An article in reference to an electric locomotive, which is in use on the Sanford & Cape Porpoise Railway Company, Sanford, Maine.

January, 1895.—An illustrated article in reference to a plow manufactured by the White Manufacturing Company, of New York, as designed by L. J. Hirt, formerly master mechanic of the West End Street Railway Company. This plow is constructed wholly of steel, with the exception of the cab, in which the motor is hung on an independent cradle. It takes two men to operate the plow—one to operate the motor and the other the plow shears. It is provided with a complete walkabout, enabling the man to walk to any part of the car without dismounting. I believe the West End or Boston Elevated has some in use on its system.

January, 1895.—A reversible snow plow which was in use by the Pennsylvania Traction Company, of Lancaster, Pa., and designed by the master mechanic of the company. It is claimed that it was very satisfactory.

January, 1895.—An article in reference to the Taunton Nose Plow.

March, 1895.—"A Home-Built Snow Plow," by E. E. Knowles, superintendent of the Spokane (Wash.) Street Railway Company. This article is very interesting with illustrations of the plow at work during a heavy snow storm in a suburban country district.

May, 1895.—"A Home-Made Sweeper," by I. B. Walker, superintendent of the Sioux City Traction Company, which is well worth reading.

April, 1895.—An article in the JOURNAL shows the results of a rotary snow plow on the Rochester Street Railway during the winter of 1894. Another good account is given of the plow in the issue of October, 1896.

February, 1897.—There is a fine article in the JOURNAL from James H. Bates with reference to cleaning snow from the tracks.

March, 1897.—A description of a snow plow designed by the chief engineer of the Galesbury Electric & Motor Power Company, of Galesbury.

February, 1898.—A description of a plow built by J. G. Brill for the Portland Street Railway Company, Portland, Maine.

March, 1898.—A description of a Taunton Plow for the Portland & Cape Elizabeth Street Railway Company, Portland, Maine.

December, 1898.—A substitute for salt for removing snow. It is a composition called "Triple Chloride," and can be applied by an ordinary sprinkling pot. It is claimed by the manufacturers that it has less corroding effect upon the iron and copper than salt. It is manufactured by the Fitch Chemical Company, Bay City, Mich.

January, 1899.—The method of keeping the tracks clear of snow in Detroit is described. Each car can be fitted with a 2-ft. x 10-ft. board, carried on the rear end of the truck frame. With light snows every fourth or fifth car is equipped with this board. With a heavy snow all cars carry them. The cars travel in a loop so that the board always remains under the rear platform.

February, 1899.—The methods employed in Newport, R. I., are described.

May, 1899.—The practice in Montreal of using rotary plows is the subject of a communication. These plows cut their way through drifts 10 ft. high.

August, 1899.—An article on the practice in Quebec. Here the main dependence is on sweepers.

May 5, 1900.—This article gives a description and news of the latest type of snow plow used by the Boston Elevated Railway Company, and made by the Taunton Locomotive Manufacturing Company.

Sept. 1 and Oct. 13, 1900.—The new snow plow of the Taunton Locomotive Manufacturing Company is described.

Sept. 29, 1900.—This number contains a full report of the recent Buffalo convention of the New York State Street Railway Association, in which an extended discussion was held on snow plows. [Mr. Danforth's paper on this subject appeared in the STREET RAILWAY JOURNAL for Oct. 20.]

[*Street Railway Review*]

December, 1893.—An article in reference to a reversible snow plow, built by Fleming Manufacturing Company, Fort Wayne, Ind.

January, 1898.—A description of a snow plow built for the Portland Railway Company. This is referred to in the February, 1898, edition of the STREET RAILWAY JOURNAL.

February, 1898.—An illustrated article regarding a car that was built for salting the tracks when the rails are covered with sleet. It also has a plow attached, which can be easily removed, and the car used for construction purposes.

January, 1899.—In this isue there is quite an extensive article of the snow storms in Denver, and photographs of the different types of plows and sweepers.

January, 1899.—"Removing Snow in Various Cities." This is an article compiled after receiving letters from different parts of the country, and has illustrations of various types of snow plows.

March, 1900.—An article in regard to a snow plow built by the Orono & Old Town Railway Company, of Bangor, Maine, which they say proves very satisfactory. The article is illustrated.

March, 1899.—An account of the way the Chicago Suburban roads handle snow. These roads run through strips of prairie country, and the handling of snow is a serious question. In the same issue there is an article from the Metropolitan Railroad Company, Washington, D. C., regarding severe storms. They state that in many places along the line the slot had been closed with solid ice. In such cases gasoline was sprinkled and burned out.

THE PRESIDENT.—I understand that Mr. Bodwell, of the Sanford

& Cape Porpoise Railway Company, which operates electric locomotives on its road, is here with us, and we should certainly like to hear from him.

Mr. Bodwell.—We have one heavy nose plow, with wings, and two freight locomotives with steam locomotive fronts. One is equipped with two No. 3 Westinghouse motors, and the other with four 38 B. We use the freight for keeping the road open, and the snow plow for throwing back the snow. We find the four-motor equipment, with double trucks, to be the best we have for going through snow. We do not mind having two sets of wheels insulated by either snow or ice, as the other two sets will give us both the traction and power required to go through the snow. We have gone through sleet storms with ¾-in. of ice on the rail with very little trouble. We also have two trolleys on the locomotive; one will break the ice on the trolley wire, and the other gives us the power. The road was not blocked at any time during the winter, and our bill for handling 24 miles of single track was $500.

Mr. Henderson, of the Newton Street Railway Company.—In the early days of electric railroading it was hard to tell what kinds of plows were the best to adopt, and I must admit that my first plow was entirely inadequate for the demands put upon it. It was built after the old cheese box plan, a square house containing two F 30 motors, mounted upon the deck of a small flat car, and operated by means of the sprocket chain. At this time I was an earnest advocate of a plow with inclosed deck, with motors mounted upon the axles. I had one built according to my ideas, and have used it up to the present time, and it has proved its value in all the storms. We now have two nose and two shear plows, the latter being built by the Wason Company, which has embodied many features which are, to my mind, desirable and useful. This plow, with its wings, does remarkable work in heavy storms. The secret of keeping a track clear in a snow storm is a combination of plenty of power, the preparing of the rails in advance through the work of sand cars, thus securing traction when most needed, and good working plows. We are required by the city officials to remove from the streets all surplus snow, and with great promptness. This is really the most costly part of a storm, but by working in harmony with these officials this can often be reduced, and it is often possible, except in the strictly business sections, to have the streets in a satisfactory condition through the aid of the plow and levelers.

The President.—I should like to hear what Mr. Shepard, of the Lawrence & Reading Street Railway Company, has to say on the subject.

Mr. Shepard.—I think that I am about the oldest snow fighter around this section, having been at it for the past eighteen years, and I have used about every plow there is on the market. For several years past I have used the Wason plow, and its work has been very satisfactory, needing very little repairs. I have also been using for the past two years a small plow attached to the ends of the box cars, which does excellent work in light snow. This plow is made by using two 1¼-in. x 6-in. x 5½-ft. pieces of plank, joined together "V" shape, reinforced at the point with a ⅛-in. band of iron the full width of the plank, and running back about 8 ins. At the rear end of this "V," iron scrapers, the same as are usually used, are attached, and the whole is hung to the car platform with the same arrangement as is used in hanging the Dorner & Dutton scraper. I have been using these plows with single truck cars, but I am going to use them on double-truck cars this winter, and if any of my brother superintendents would like to see this small plow on the cars I would be pleased to show them, if they will give me a call.

The President.—Mr. Pierce, president of the Fitchburg & Suburban Street Railway Company, is here to-night, and we would like to hear how he handles snow along that piece of track, with its 13 per cent grade.

Mr. Pierce.—As president of the Laconia Street Railway Company, Laconia, N. H., I had an opportunity to learn the way that L. H. Pierce, its superintendent, handled the snow storms there. He always worked in harmony with the superintendent of streets, who leveled the snow, and then rolled it with a large roller after it had been thrown from the car tracks. In fighting snow storms on the Fitchburg & Suburban and the Leominster & Clinton we have experienced considerable difficulty in not having sufficient power, and I believe that if the suburban roads had sufficient power to operate all their cars and plows during a snow storm they could keep the line open.

Thomas F. Carey, representing the Wason Company, and Percy Hodges, the McGuire Company, were present, and were obliged to answer many questions, which were very interesting and instructive.

E. E. Potter, of the Union Street Railway Company, New Bedford, Mass., and C. F. Baker, superintendent motive power and machinery, of the Boston Elevated Railway Company, also made a few remarks on the subject.

After the discussion a vote was passed authorizing the president to appoint a committee of three to select a subject for the next meeting.

After adjournment the members proceeded down Federal Street in a body to O'Brien's Fish Grill, where a lunch was enjoyed by all.

Fares and their Effect on Receipts *

BY H. GERON, MANAGER OF THE COLOGNE STREET RAILWAY COMPANY.

This paper is based upon replies to the following questions sent to the members of the association:

Have your fares been materially altered during the past five years?

Of what nature were these alterations?

What were your reasons for making them?

What effect did they have on (1) the receipts; (2) the expenses; (3) the profits?

Do you consider your present fares reasonable and satisfactory?

All replies may be grouped together under the two words, "Reduction" and "Simplification," and in most cases the fare has been made uniform and the right of transfer has been granted within city districts. In suburban districts uniform fares have not been found satisfactory.

At Aachen, on an 82-km road, the fare was reduced considerably in 1897-98, so that within city limits it was a uniform 10 pf. and in suburban districts 5 pf. per 1500 m; the minimum being 10 pf. The effect of the first change was remarkably good, but the last-named rate did not increase the traffic. Eight and a half million passengers are carried by this road every year.

At Elberfeld-Barmen the uniform 10 pf. fare was introduced in 1897, the year electricity was adopted, and the result was that the traffic increased from 5,000,000 in 1895 to 13,500,000 in 1899. The company advocates a uniform fare for lines where traffic is heavy, the headway small and where the set of passengers frequently changes. On Sundays and holidays it may be advisable to graduate the rates so as not to induce passengers to ride over the entire route for the small uniform fare.

In Brussels, where 41,000,000 passengers are transported yearly, the uniform rate has given entire satisfaction and the company reports that on several lines its receipts per car km have remained the same. It is proposed to reduce the fare at an early day to 20 centimes for the first class and 15 centimes for the second class. The 133.5-km road in Hamburg, where 61,000,000 are carried each year, has continually reduced the fares, and it was possible to reach the nearby suburban towns for 15 pf. The company reports, however, that while the traffic increased 12.3 per cent, the receipts increased only 9.9 per cent, due to this reduction, which is not a very favorable result.

The Geneva company advocates a uniform 10-centime fare, which it claims is about 5 centimes per km. In Hanover, where 27,000,000 passengers are carried yearly over a system 186 km in length, the reduction of fares was carried to such an excess that a person could ride 8 km for 10 pf. It is the intention of this company to increase its fare on lines leading into suburban districts.

In a paper read by Manager von Pirch in 1899, at the Elberfeld meeting of the Verein Deutscher Strassenbahn und Kleinbahn Verwaltungen, it was stated that out of forty-six street railways, thirty-nine of which used electricity, twenty-one, or 45.6 per cent, had a uniform fare of 10 pf.; 17.4 per cent a uniform fare in the city and sectional rate outside of city limits, and 37 per cent a sectional rate only; 78.3 per cent used the transfer system, and 47 per cent of these had a uniform fare, which shows that the transfer system is a profitable one.

In deciding upon a change of fare the company must look ahead and carefully consider the density and growth of the population, the length of its franchise, the contour of the city and its streets, the financial situation and other local conditions. We can therefore only state the following general conclusions:

(1) The rates are to be arranged for city roads as simple and cheap as local conditions will permit.

(2) For large cities a uniform rate for a large area, excluding suburban districts, seems most profitable.

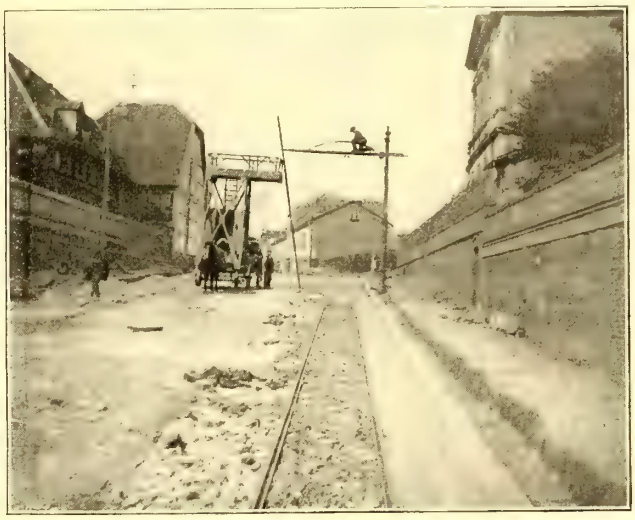
(3) The transfer system is profitable, but each specific case must be decided on its merits.

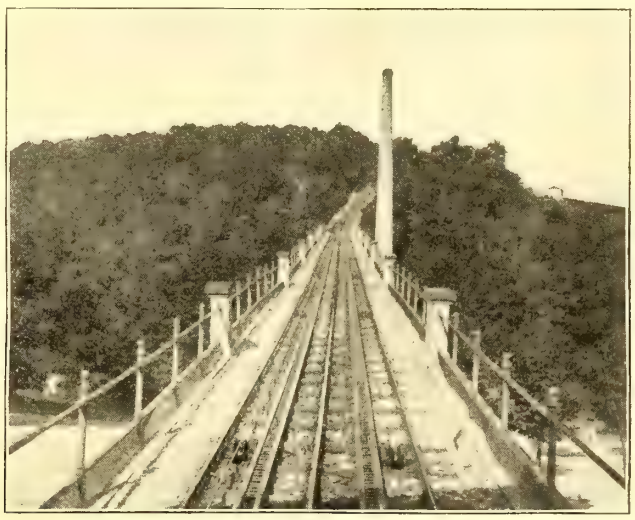
* Abstract of paper read before the International Tramway Congress, September, 1900.

Annual Meeting of the Verein Deutscher Strassen- und Kleinbahn Verwaltungen

The sixth annual meeting of the Verein Deutscher Strassen- und Kleinbahn Verwaltungen was held at Wiesbaden, Sept. 6-9.

The delegates were greeted by the committee on the evening of Sept. 5, the host being the Süddeutsche Eisenbahn-Gesellschaft, of Darmstadt, the company which operates the electric roads of Wiesbaden and the cable line running up to the top of the Neroberg. As the cars on this latter line are supplied with water ballast while descending, a pumping station has been installed at the foot of the incline. On the electric cars trolley wheels were formerly employed, but at present the Siemens sliding contact is employed, as the company desired to use as few wires in the overhead construction as possible. The engravings also show the latest method adopted to protect telephone wires. It consists of a grounded wire suspended above the trolley wire. The execution of this work has been so tastefully done that it does not in the least mar the appearance of the streets of Wiesbaden. The trolley poles also are hidden from view as much as possible, and the principles adopted throughout are beauty and cheapness.





VIEWS IN WIESBADEN, SHOWING THE STREET RAILWAY SYSTEM

The first session was opened on Sept. 6 at 9:15 a. m., by President Roehl, of Hamburg, and after the usual greetings Director Thorné, representing the engineering department of the local street railway company, greeted the representatives of these roads, and praised their careful and conscientious work, which, he said, is far superior to those exercised by the owners of State railways.

The annual report of the executive committee was then read. It is given in abstract below:

REPORT OF EXECUTIVE COMMITTEE

It is gratifying to note that the membership of the association has increased from 93 to 100 during the past year, and that only four companies have withdrawn on account of being consolidated with other roads. The association has been very active during the year, and nearly every committee appointed at the last meeting has its report to make, and many of these reports are of great and permanent value. The paper by Mr. Oudendijk on "The Telegraph Road Law and Its Effect on Electric Street Railways," has received the attention of the postal authorities, and the latter has ordered the installation of safety fuses, as recommended at the last general meeting. It is surprising to learn, however, that the authorities expect the railway companies to stand this extra expense. Generally the person who makes an error has to pay for removing it, but in this instance the reverse seems to be the case. It is quite doubtful whether the companies are under any legal compulsion to carry out this plan, and it is to be hoped that the authorities will adopt the alternative safety device recommendations proposed by the association. Again, we regret that the authorities still insist on the maintenance of mechanical safety devices, regardless of their inefficiency, as evidenced by the burning of the large telephone exchanges at Barmen, Zurich and Dortmund. In all three cases the blame rested with the postal authorities, as shown by competent experts. All this evidence proves the uselessness of guard wires, the maintenance of which is an enormous yearly expense to the railway companies.

The proposition made by Postmaster Canter at the last general meeting to ground broken telephone wires has not been indorsed by the postal authorities. The new telegraph road law also has

not come up to expectations, and the great demands made by it in regard to the removal of existing telegraph lines has stood in the way of building, by private capital, many needed roads. Although the government has appropriated large sums for the laying of metallic returns for telephone lines, it appears from reports that the expense has still to be largely borne by the railway companies.

Referring now to the questions propounded by the Elektrotechnische Verein as to the probable damage done by electric roads to existing gas and water pipes, the association has done its utmost in assisting to collect data. It is the general opinion that the problem will soon be considered by the government itself. Further to aid in the work the association has asked for representation on the commission of the Elektrotechnische Verein, and Messrs. Gunderloch, of Elberfeld; Poetz, of Hamburg, and Oudendijk, of Cologne, have been chosen. Nothing definite has been reported by the commission at this time. In regard to the work of the committee on safety devices for mean-pressure installations, Director Gunderloch will make a report. The committee consists of Messrs. Gunderloch, of Elberfeld; Oudendijk, of Cologne; Grotewold, of Hanover; Henizerling, of Berlin, and Poetz, of Hamburg. Their report will probably serve as a guide to the government, and will be awaited with a great deal of interest.

Referring now to the extent to which companies permit smoking in their cars, sixty-five replies have been received, which show that nine companies permit smoking in closed cars, eight permit it in separate compartments, thirty-one forbid it entirely within cars, one permits smoking in trailers, one is utterly opposed to smoking, one even forbids smoking on front platforms, five have several smoking cars in operation, and eight companies, operating horse cars, have not considered the question at all. These replies show that most companies permit smoking on the platforms only, and that only very few companies have found separate smoking cars or compartments a success.

A number of companies have requested information in regard to the State requirements relative to the desire of street railway companies to connect with larger roads, and most of them report the conditions entirely too severe. The replies to inquiries received show that the conditions practically forbid any such arrangement with Prussian railways. One company even reported that it had received an official reply, which, after stating severe conditions, concluded with the remarkable statement that if the company did not feel like complying with them it could suspend operations, and the public could take their goods to the next railway station, and forward them from there. This is contrary to the government's desire to extend the street railways of the empire, and certainly against the spirit of the times. It will stop private capital from coming forward for street railway building purposes, and unless the State itself aids in supplying the necessary funds, an unwelcome cessation in street railway building may be expected.

Another question which has interested the association during the past year is that of wages and working hours of employees. The subject is not so much an economic as a political problem. It appears as if most of the recent disturbances were inspired by the Social-Democrats for political purposes. Against such tactics all companies should proceed in force, and questions relating to wages and hours of labor should be decided by the employers themselves, *i. e.*, the companies. The request of the Social-Democrats to aid them in compiling statistics relative to the wages and hours of labor of employees has been complied with, and the members have been requested to answer the questions asked on a blank sent to them for that purpose.

After the reading of the report Engineer Vellguth, of Hamburg, made some remarks on the accident returns for 1899 from fifty-eight German street railways. He said, in part:

ACCIDENTS ON GERMAN STREET RAILWAYS

The questions presented were replied to by fifty-eight companies, representing 156,769,813 car kilometers and transporting 530,287,191 persons annually; in addition, 1,142,954 freight car kilometers were traveled. One hundred and seventy-two accidents have been reported, making one case for every 3,083,065 passengers actually carried, and this number was 41.1 per cent of all accidents reported due to the street car traffic. Among all the passengers injured there was only one child, while most adults were injured through carelessness in entering or leaving cars; no child has been injured in this way, but eight accidents are reported which call for special mention. They happened to infants carried by adults who were careless in entering or leaving the car while it was still in motion and let the child slip from their grip. In all, 247 persons were injured who were not actually passengers, making one for every 639,323 car kilometers. Of these persons 33.2 per cent were children, which is to be ascribed to carelessness, inexperience and lack of supervision. The practice to arrest parents guilty of the last named crime and whose child has been injured is recommended. Of the 293 dangerously injured persons, 147 were passengers and 146 pedestrians. The following decreases are noted during 1899 over 1898: Accidents due to entering or leaving cars and too great a speed around curves and accidents to children. The following increases, however, offset the above: Accidents due to collisions, which, however, did not affect the passengers as much as pedestrians and wheelmen. More persons were injured due to leaving the car before it had come to a full stop. All of this points to a more efficient and better disciplined force of employees and more effective brakes.

A total number of twenty-eight accidents are reported as being due to the trailers, or one for every 768,523 cars kilometers. The motor car is 1.4 times as dangerous as the trailer. The argument that trailers are extremely dangerous is not well founded, as the danger lies in front of a car, and the trailer having a car in front removes this danger, which would be far greater if a number of motor cars should be employed to take care of the traffic.

The above figures, which are carefully tabulated in the report, do not include the accidents reported by the Grosse Berliner Strassenbahn. On the several lines of this company 2687 persons were injured, 16 of whom fatally and 101 seriously; 1726 of the total number were males and 961 females; 2493 were adults and 194 children, and 1978 were passengers on cars; 79.5 per cent of the cases were due to the carelessness on the part of the persons injured; 41.03 per cent were due to passengers leaving the cars; 10.26 per cent to boarding the same; 15.4 per cent fell from the platforms due to some unknown cause; 1639 happened during the day and 1048 at night; 1371 were injured by motor cars and 1316 by horse cars.

It is interesting to note, in conclusion, that while vehicles transporting goods injured 16.97 persons out of every 1000, the street cars are only responsible for 4.21, or one-quarter of that number.

A paper on brakes was then read. It was, in part, as follows:

THE VALUE OF DIFFERENT KINDS OF BRAKES USED ON ELECTRIC RAILWAYS

BY MESSRS. FROMM AND POETZ

Question papers containing twelve essential questions relative to brakes were sent out to one hundred companies, and sixty-three of them sent in replies. The latter show that the majority of electrically operated cars are equipped with short-circuit brakes, a small number have eletromagnetic brakes, and a few use both systems. Some have air, track and other brakes in addition to their electric brakes. Ten roads use the short-circuit brake as an ordinary working brake, twenty-one as an emergency brake, one for both, and three use it as a working brake under certain conditions. It is found that the two-axle cars weigh, empty, between 6000 kg and 9500 kg, and from 8000 kg to 11,975 kg loaded; the four-axle cars weigh from 10,000 kg to 15,000 kg empty, and from 14,500 kg to 18,000 kg loaded; the two-axle trailers from 2000 kg to 4000 kg empty, and from 4500 kg to 7250 kg loaded, and the four-axle trailers from 4500 kg to 7200 kg empty, and from 12,000 kg to 16,000 kg loaded. Most companies use two-axle trailers supplied with hand brakes.

The greatest speeds permitted on the various roads vary as follows: Five roads, 12 km; ten roads, 15 km; five roads, 18 km; thirteen roads, 20 km; twenty-one roads, 25 km; two roads, 30 km, and the Düsseldorf-Krefeld road, 40 km. In regard to the distance within which a rapidly moving car must be able to be brought to a standstill, a great variety of replies has been received. The average distance for cars going at a speed of from 15 km to 20 km per hour is from 8 m to 12 m when the car is empty, and from 10 m to 15 m when the car is loaded.

Another great variety of replies has been received in answer to the question as to the current and pressure required by the brakes. They vary from 50 amperes to 70 amperes at 150 volts to 180 volts, to 30 amperes to 40 amperes at 440 volts to 450 volts, or even 130 amperes to 150 amperes at 425 volts to 450 volts, and one road employs a voltage as high as 1000 volts. In all, the current varies between 65 amperes and 200 amperes, and the voltage between 400 volts and 1000 volts.

Electromagnetic brakes in general have been found very satisfactory, as have also the air brakes, those of the Standard Air Brake Company being especially recommended. It is claimed, however, that many traffic interruptions are due to the freezing of pipes and valves, and the repair costs of air brakes are also high.

The commission made a number of experiments with the new Schieman track brake on some of the Hamburg lines. The formula employed for obtaining the braking power P was:

$$P = \frac{G\,v^2}{2g\,l}$$

Where G is the weight of the car in kg,
v the speed in meters per second,
g the acceleration of gravity,
l the braking distance in meters.

The braking distance for electromagnetic axle brakes was found to be for a speed of 22 km per hour:

	Track Dry	Track Wet	Track Slippery
Two-axle, one-motor car	10.68 m	10.97 m	21.01 m
Two-axle, two-motor car	8.27 m	10.99 m	24.79 m
Four-axle, two-motor car	9.55 m	9.91 m	14.10 m

The slippery track is overcome largely by the free use of sand in actual practice. The current for single-motor cars was 70 amperes; for two-motor, two-axle and four-axle cars up to 150 amperes per motor. As these currents are only used for short periods, the motors are not injured.

The braking distances with the Schieman brake were found to be:

	Meters
With dry track	8.22
With wet track	5.20
With slippery track	17.12

which is a very gratifying result.

The following are the conclusions drawn by the commission from the replies received:

1. In general, electrical short-circuit brakes used as emergency brakes are very successful.

2. Electromagnetic brakes are recommended for heavy cars, and where the grade is variable.

3. Air brakes have given good satisfaction, and only time will tell whether the defects pointed out at present are inherent to the system or not.

4. Other braking systems cannot be judged at the present time, as they have not been used on a large enough scale and for a long enough time to permit the passing of judgment.

The discussion on this paper was opened by Director Fromm, of Kelsterbach, who explained that it had been found necessary to make extensive experiments in order to hand in a report worthy of its title. The requirement that cars should be stopped within their own length when going at a high speed is seldom necessary. The various replies showed that the use of short-circuit brakes caused the ruination of gear wheels and the burning out of armatures, and that magnetic brakes were preferable. In most cases the electric and magnetic brakes are only to be used in emergencies, and it happens frequently that the motormen cut them in so quickly as to injure the passengers. Engineers Poetz, of Hamburg, and Fromm, of Kelsterbach, were requested to continue these interesting experiments, and to report at the next meeting.

Director Gunderloch, of Elberfeld, then read the report of the Elektrotechnische Verein on the question of safety devices for electric street railways, which has been treated extensively in these columns. Great differences of opinion were expressed in regard to the earthing of lamps and apparatus in the cars. The representatives of such firms as Siemens & Halske, A. E. G., Schuckert, etc., all recommended the earthing, while the operating companies in general opposed it. The former fear that passengers entering the car may receive a shock by taking hold of the brass hand-rail, should the car become charged through defective apparatus. Above all, the controller should be earthed, so that the motormen can not make a short-circuit between the hand-brake and controller cylinder. The railway companies, on the other hand, claimed that the earthing might cause traffic disturbances, and that no one has ever been hurt by such short-circuits.

In regard to the question of wages, a few remarks were made by Director Roehl, of Hamburg, and they may be summed up by stating that it is simply a question of might against might. The Berlin strike has shown that places on railways are eagerly sought, 22,000 persons having applied for work in two days. On the other hand, it is the desire of the companies to make the relations between themselves and their employees as cordial as possible by the establishment of pension funds, fair treatment and reasonable division of working hours. The motorman overestimates his knowledge, and forgets that it is far easier to train a green motorman than a green driver, and that the latter must be much stronger physically. It should be remarked that in Dusseldorf the motorman is only permitted to work 312 hours per month in winter, and 324 hours in summer, which, for an average of twenty-seven days is 11.6 to 12 hours per day. In Hamburg, on the other hand, no motorman is allowed to work more than ten hours per day, which the company claims is a good figure to ensure public safety. This arrangement actually calls for 9½ to 9¾ working hours per day.

The next report taken up by the association was that by Engineer Vellguth, of Hamburg, on the relative cost of operation of two and four-axle motor cars and trailers. An abstract follows:

COST OF OPERATION OF VARIOUS METHODS ADOPTED BY ELECTRIC STREET RAILWAY COMPANIES

BY H. VELLGUTH, OF HAMBURG

It cannot be denied that the railway manager would find it of great value, and, in fact, almost essential, to know the cost of operation of two-axle and four-axle motor cars, and two-axle motor cars with trailers, as well as the effect of each type on the income on his different lines. If he studies these items carefully he will find that different types are better or worse adapted for different periods of the day. There are floods and ebbs in traffic, and the factors which cause these variations should determine the most efficient method of running the road. This information is highly essential in view of the fact that the running of street railway lines is becoming more expensive every year, as the obligations to city and State and the actual cost of operation are greater.

In compiling tables on operation the expenses were divided into the following three classes:

1. Running expenses.
2. Money laid aside for future purchases.
3. Sinking fund.

If Z represents the total expenses for the year in pfennig, M_2 the number of two-axle car kilometers traveled, M_4 the number of four-axle car kilometers, A the number of trailer kilometers traveled, $\frac{a}{b}$ the fraction for trailer, taking the two-axle car as a unit, and $\frac{n}{m}$ the fraction for the four-axle car, and Ra the cost in pfenning per trailer car kilometer, then:

$$\frac{Z}{\frac{b}{a}\left(M_2 + \frac{n}{m} M_4\right) + A} = R_a \text{ in pfg}$$

by multiplying this by $\frac{b}{a}$ we get the cost per two-axle car kilometer, or

$$R\,M_2 = R_a \frac{b}{a}$$

and

$$R\,M_4 \quad \frac{n}{m}\,R_2$$

is the cost per four-axle car kilometer.

Then the author presented as an example the actual figures gathered from the Hamburg Street Railway Company, where the fractions $\frac{b}{a}$ and $\frac{n}{m}$ are figured out.

The conclusion is finally reached that only during times of great traffic does it pay to run trailers.

In the discussion the author pointed out in great detail the constant diminution of profits and increase of expenditures. He further claimed that it is an easy matter for the manager of a road, who keeps a strict account of his expenditures and accurate statistics of his traffic, to gage the profit or loss of each trip, day or week, and he can find, by experiments, what type of car or arrangement of cars would be best suited for his road. It was the object of the author to gather individual statistics, and later group them together into a general resumé. The former consist of the following: Weight and number of passengers, weight and seating capacity of cars, number of employees, space required for storage of cars in barns and shops, the first cost of the cars, current consumption per car, the cost of repairs on cars, their cleaning, etc.

President Roehl strongly recommended the paper for careful perusal, as it might convince a number of managers that it would pay them to make a change in the present methods of running their roads.

At the second session, on Sept. 7, Director Fischer, of Posen, made a report on municipal street railway requirements, and he pointed out that local police authorities frequently exercise the right which legally belongs to the higher State authorities. His remarks were of great interest, but related particularly to Prussia. The remarks were supplemented by Attorney Ullmann, also of Posen.

Doctor Rollman, of Frankfurt, then made a report on the transportation facilities at the Paris Exposition, in which he stated that in the plans the builder had exercised more influence than the railway engineer. The lines are unfavorably located for the transportation of large numbers of people. On account of the well known neglect of the street railways of Paris, neither the American Street Railway Association nor that of Germany found it expedient

to be represented officially. Only a few United States and German representatives were present for the purpose of gathering private information.

Dr. Eger, of Berlin, one of the two most prominent German legal authorities on street railways (the other being Prof. Dr. Hilse, of Berlin), then made some interesting statements in regard to the interpretation of the German street railway laws, how to check municipalities in demanding too many concessions from the street railway company, and how to compel them under certain conditions to permit street railway companies to make use of the streets.

The report of the Literary Commission was then read, and consisted of a financial statement of the society's organ, the *Mitteilungen des Vereins deutscher Strassenbahn und Kleinbahn Verwaltungen*, and the members of the commission expressed the hope that the paper would in the future publish reports equal in value to those printed in the Street Railway Journal. It was further pointed out that the publisher of another German railway paper claimed to be the organ of a German street railway association which had gone out of existence.

It was further decided that the managers of German street railways make a trip through the United States about the end of May, 1901. The names of cities to be visited were decided upon, and have already been announced in these columns.

The advisability of publishing street railway statistics similar to those of large steam roads, as proposed by the Minister of Railways, was then taken up for discussion. While the difficulty of such an undertaking was recognized, it was decided to attempt to compile this great work. It was decided, however, that the Minister of Railways would have to bear the expense. It was further pointed out that the society could not force its members to submit the desired information, but that this must be procured by the Minister himself, in case there is such a requirement in their franchise. The statistics should embrace all German street railways, and should cover the following items: Expenses, income, length of road and track, number of persons and goods transported, etc.

The budget for 1901 shows a deficit of M.750, which will be covered by the surplus of former years. The capital of the society, which is incorporated, is M.12,000. It was decided to hold the next convention at Stuttgart, Wurttemberg. The banquet and excursions were well attended, and thoroughly enjoyed by all, and a vote of thanks was tendered to the operating company in Wiesbaden for its hospitality.

Boston and the Vestibule Question

The Massachusetts Railroad Commissioners gave a hearing, Oct. 18, on the petition of the Boston Elevated Railway for exemption from the provisions of the statute which makes it compulsory for railway companies to equip their cars with vestibules. The hearing was a most important one, and much valuable testimony was introduced by the company to show that the vestibule was a hindrance to the motorman in performing his duties. The plea made by those opposing the company's petition seems to have been prompted by humanitarian impulses, and those who had had no practical experience in the operation of cars. On the other hand, the company introduced expert testimony to prove its point. The officials of the company stated their reasons for applying for exemption from the act, and then introduced a number of motormen, who testified as to the inadvisability of compelling the company to equip the cars with vestibules. Their testimony was especially valuable, as they alone had had the practical experience. It was pointed out that the vestibule obstructed sight, and interfered with the hearing of the operator of the car, and that it was particularly trying in stormy weather and at night. It was shown that on a very dark night it was impossible for the motorman to see beyond the glass front, also that the bright car lamps at the back of the motorman throw a figure of the operator upon the window, the effect being that the reflection appeared to be approaching the car while it was in motion. The hearing will be continued on Nov. 16, when some more valuable information on this subject will likely be presented.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

ELECTRIC RAILWAY PATENTS ISSUED OCT. 16, 1900

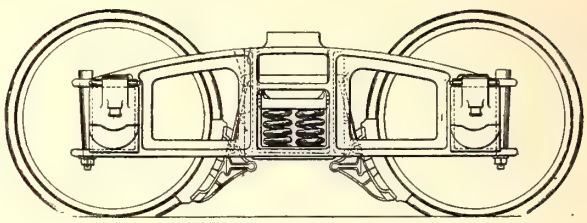
659,692. Switch Operating Device; H. B. Pierre, Torrington, Conn. App. filed March 27, 1899. A foot-operated wheel, carried by the car, is thrown down to a position where it will trip a device for shifting the switch tongue.

659,707. Railway Turn-Table; J. S. Stephens, Maywood, Ill. App. filed March 19, 1900. Consists of a tilting circular platform, supported on a head provided with a double fulcrum, the head being mounted on ball bearings on a suitable base.

659,812. Rail-Joint; J. Crites and J. Webb, East Liverpool, Ohio. App. filed Feb. 5, 1900. Consists of two plates, which lie on the under side of the rail, and extend around the flanges and embrace the sides of the rail, the plates being secured together by a locking device of specific construction.

659,848. Switch Shifting Mechanism; W. Hamilton, National Military Home, Ohio. App. filed July 12, 1900. The switch tongue carries small pivoted extension, which lies in the groove of the track ahead of the tongue. A shifting shoe carried by the car is lowered into the groove, and acts on the extension to throw the tongue from one side to the other.

659,903. Car Truck; W. E. Symons, Savannah, Ga. App. filed Aug. 19, 1899. Structural details of a "boltless" car truck.



PATENT NO. 659,903

659,982. Car Fender; J. W. McKean, Charleroi, Pa. App. filed Feb. 26, 1900. The fender is pivoted to the car, and carries a segment of gear, which stands normally out of engagement with a pinion on the car axle. When the fender strikes an object the segment engages the pinion, and the fender is thrown into position to prevent the object passing under the wheels.

PERSONAL MENTION

MR. P. McCULLOUGH, of Sherbrooke, Que., has been appointed assistant manager of tramways at Liverpool, England.

MR. A. L. WIGHT, auditor of the Toledo Traction Company for the past eleven years, has resigned to accept a position in Chicago.

MR. WILLIAM H. WILSON, who has been in charge of the electric railway lines owned by the South Jersey Gas, Electric & Traction Company, has been appointed superintendent of the lighting interests owned by the company, to succeed Charles H. Fowler, resigned.

MR. J. W. CROSS, of the Adams & Westlake Company, of Chicago, died at his home in Philadelphia, Saturday, Oct. 6, 1900. Mr. Cross has been connected with the Adams & Westlake Company for a number of years, and his death will be keenly felt by both his employers and many business associates.

MR. BION J. ARNOLD, of Chicago, has just returned from a three months' trip to Europe, where he went as a delegate from Chicago to the International Electrical Congress. Mr. Arnold traveled through England, Italy, France, Germany and Austria, and found many things of interest in the electrical line.

NEWS NOTES

HUNTSVILLE, ALA.—The construction of an electric railway from Huntsville to Whitesburg, on the Tennessee River, is being discussed by local capitalists, and it is stated on good authority that a company will soon be organized for the purpose of constructing the line. It will be about 10 miles long.

LITTLE ROCK, ARK.—Mrs. J. R. Miller has offered the City Council a large cash consideration for the street railway franchises in this city, which the Council claims expire in 1905.

GREENWICH, CONN.—The Selectmen have granted the application of the Greenwich Tramway Company for permission to lay tracks from Port Chester, N. Y., to the Greenwich station. This route will make a short cut from Port Chester to Greenwich, and later the line will be extended from Greenwich to Stamford, thus making through trolley connections between New Haven and New York.

WILMINGTON, DEL.—The Wilmington & West Chester Railway Company, which proposes to build a road to connect Wilmington and West Chester, has made application to the Street and Sewer Department for permission to lay tracks on various streets in this city. The Wilmington City Railway Company has also made application for permission to extend its pro-

posed Monroe Street line to Ninth Street, and then to the city line, where connections will be made with the proposed Wilmington & West Chester Railway. It is understood that the Wilmington City Railway and the proposed West Chester line have made arrangements, which include a system of transfers throughout the city. The Wilmington City Railway Company secured from the Levy Court an extension of six months on its franchise to use Washington Street Bridge, over the Brandywine Creek.

WASHINGTON, D. C.—Arrangements have been made between the Columbia Railway Company and the Chesapeake Beach Railway Company by which express matter and freight of less than car-load quantity will be handled from a station which has been established at Fifteenth and H Streets northeast to all points on the extension of the Columbia line and on the Chesapeake Beach Railroad.

WASHINGTON, D. C.—The Baltimore parties who have been contesting the charter of the Washington & Gettysburg Electric Railway in the courts of Maryland and Washington have been defeated, and the last obstacle preventing the construction of the road is removed. The officers of the company are: George H. Harries, president; S. W. Woodward, vice-president; B. H. Warner, secretary and treasurer; John B. Larner, general counsel; S. W. Woodward, Crosby S. Noyes, E. Southard Parker, J. Enos Ray, Allan Farquhar, Albert Gleason and George H. Harries, directors.

JACKSONVILLE, FLA.—The City Council has granted the Pleasure Park Company a franchise for the construction of an electric railway here. R. S. Shook is interested in the new enterprise.

ATLANTA, GA.—The petition of the Atlanta Rapid Transit Company to extend its lines to connect with the old Lakewood line has been favorably acted upon.

WAYCROSS, GA.—The Waycross & Suburban Railway Company has been granted a franchise for the construction of an electric railway here. The franchise is granted for a period of fifty years.

EAST ST. LOUIS, ILL.—The Collinsville, Caseyville & St. Louis Electric Railway was placed in operation Oct. 20.

CHICAGO, ILL.—The old car house of the Chicago Union Traction Company at West Van Buren Street and Center Avenue was destroyed by fire last week. The house had not been used by the company for some time, and it had of late been used for storing wagons.

CHICAGO, ILL.—The Citizens' Street Railway Association, whose incorporation was noted in the STREET RAILWAY JOURNAL for Oct. 20, will ask the City Council for a blanket ordinance covering about 400 miles of streets now occupied by the several Chicago companies.

CHICAGO, ILL.—By a collision of a fire department hose cart and a trolley car at Sixteenth and Vliet Streets, Oct. 17, three members of the fire department and a motorman were seriously injured.

CHICAGO, ILL.—The Chicago City Railway Company is to abandon the operation of trail cars.

CHICAGO, ILL.—A Grand Avenue car jumped the tracks and plunged in a ditch here a few days ago, injuring five persons.

CHICAGO, ILL.—The traffic report of the Metropolitan Elevated Railroad Company for September shows that 2,460,000 passengers were transported, as against 2,285,520 for September, 1899. The daily average for September, 1900, was 82,000, as against 76,184 for September, 1899. Below is given the traffic records so far this year, in comparison with those of last year:

	1899	1900
January	2,242,490	2,756,135
February	2,109,632	2,593,304
March	2,456,533	2,929,748
April	2,323,920	2,712,900
May	2,352,590	2,674,928
June	2,172,990	2,466,180
July	2,093,338	2,287,490
August	2,110,170	2,432,167
September	2,285,520	2,460,000

CHICAGO, ILL.—The traffic report of the South Side Elevated Railroad Company for September shows that 1,951,860 persons were transported, as against 1,787,539 for September, 1899. The daily average for September, 1900, was 65,062, as against 59,585 for September, 1899. Below are given the traffic records so far this year, with comparison with those of last year:

	1899	1900
January	1,821,609	2,154,624
February	1,688,176	1,961,400
March	1,981,179	2,240,184
April	1,916,340	2,149,950
May	1,847,228	2,117,176
June	1,683,510	2,036,760
July	1,631,964	1,890,132
August	1,630,569	1,908,627
September	1,951,860	1,787,539

KOKOMO, IND.—The Central Traction Company is now receiving bids for the construction of its proposed line between Kokomo, Elwood and Indianapolis.

TERRE HAUTE, IND.—The employees of the local street railway company are on strike.

GOSHEN, IND.—The City Council has passed an ordinance granting the Goshen, Wawasee & Southern Electric Railroad Company a franchise for the construction of an electric railway through this city. J. J. Burnes is interested in the new line.

INDIANAPOLIS, IND.—A Lake Erie & Western Railroad switch engine collided with a car of the Indianapolis Street Railway at Thirteenth Street Oct. 19. There were twenty-one passengers in the car at the time, and fifteen of this number were injured, four perhaps fatally.

WABASH, IND.—The Wabash River Traction Company has accepted the franchise for the construction of a line between Wabash and Peru, and has filed a bond for $10,000 to insure compliance with the terms of the franchise. The contract requires that the construction of the line must be commenced by April 1, 1901.

DES MOINES, IA.—The Des Moines Street Railway Company has made application to the City Council for the right to haul freight over its Highland Park line, and the line running east to the Fair Grounds. In return for the rights the company agrees to extend the Highland Park line to Saylorville, a distance of 5 miles, and to extend the Fair Grounds line to Saylorville, a distance of about 1½ miles. The company does not anticipate any difficulty in securing the grants.

ROCKLAND, MAINE.—The young society belles of this city acted as conductors on the cars of the Rockland, Thomaston & Camden Street Railway Company Oct. 13. The regular conductors assisted in the operation of the cars, but the young women collected all the fares. The fares received by the bewitching dames ranged from 5 cents to $5, and the total receipts are said to have reached $500, all of which was donated to the Old Ladies' Home.

BEL AIR, MD.—The Town Commissioners have granted the Bel Air & Havre de Grace Electric Railway Company a franchise to construct an electric railway on Main Street from Port Deposit Avenue to the Baltimore and Lehigh Station, provided the company secures the consent of the property owners along the route, together with certain other agreements.

BALTIMORE, MD.—The Baltimore & Havre de Grace Electric Railway & Power Company has made application to the County Commissioners for a franchise for the construction of an electric railway on the Philadelphia turnpike from the Baltimore city limits to the Hartford County line. R. P. Sword, E. S. Phillips, W. S. Sword and P. J. Phillips are interested in the company.

FREDERICK, MD.—At a recent meeting of the stockholders of the Washington, Frederick & Gettysburg Electric Railway Company the construction of the proposed line was discussed, and it was decided to place the matter in the hands of a committee of seven, who are given authority to complete plans and have the line constructed. The road is to extend from Washington to Gettysburg. The directors of the company are Col. L. Victor Baughman, John C. Motter, John Baumgardner, Wm. H. Hinks, Dr. T. E. R. Miller, C. R. Miller, C. R. Nutt, Dr. F. B. Smith, Col. L. T. Brien, Chas. Wertheimer, Isaac S. Annan, D. C. Walker, C. C. Walker, C. E. Cassell, John R. Stoner, Col. D. C. Winebrenner, E. R. Zimmerman and Alex. Ramsburg. Col. L. Victor Baughman is president of the company.

LAWRENCE, MASS.—The Lawrence & Methuen Street Railway Company has been granted an extension of time to Jan. 1, 1901, in which to complete its line here.

FITCHBURG, MASS.—At the annual meeting of the stockholders of the Fitchburg & Leominster Street Railway Company, held Oct. 16, new directors were elected, as follows: Henry A. Willis, Charles F. Baker, Herbert I. Wallace, Edgar F. Belding, George E. Clifford, Wesley W. Sargent, George N. Proctor. The following directors retired: Messrs. Haws, Lowe and Weymouth.

GREENFIELD, MASS.—At the annual meeting of the stockholders of the Greenfield & Turner's Falls Street Railway Company, held Oct. 8, the following directors were elected: F. E. Lowe, Isaac Chenery, A. T. Hall, F. E. Pierce, A. S. Paton and C. E. Dresser. The old officers were re-elected.

PITTSFIELD, MASS.—The annual meeting of the Pittsfield Electric Street Railway Company was held Oct. 17. The treasurer's report for the past year shows the gross earnings to be $79,652, the operating expenses $64,650, and the taxes, interest on funded and unfunded debt, $7,397, leaving a balance of $7,905.28. Out of this amount a 6 per cent dividend has been declared.

NEW BEDFORD, MASS.—The Selectmen of Mattapoiset have granted the New Bedford & Onset Bay Street Railway Company a location for tracks through the town. H. H. Crapo, of New Bedford, is interested in the line.

WAREHAM, MASS.—The Middleboro, Wareham & Buzzards Bay Street Railway Company has been granted a franchise here. The company has now secured all its franchises for its proposed line between Middleboro and Buzzards Bay, a distance of 23 miles. H. B. Parker, of Newtonville, is interested in the project.

SEDALIA, MO,—The Sedalia Electric Railway Company is now considering a plan for the extension of its lines to North Sedalia.

ST. LOUIS, MO.—The street railway companies have just filed their reports of the trips made and passengers carried for the three months ending Sept. 20. The report follows: St. Louis Transit Company, 579,278 trips and 18,969,047 passengers; St. Louis Railroad Company, 54,504 trips and 829,117 passengers; St. Louis Traction Company, 20,244 trips and 718,092 passengers; St. Louis & Suburban Railroad, 78,374 trips and 4,929,279 passengers. The total number of trips was 732,400, and the total number of passengers carried was 25,445,535. During the same quarter of last year the various systems made 1,195,751 trips and carried 31,745,483 passengers. The Suburban is the only system to show an increase. It made 43,950 trips during the third quarter of 1899, and collected fares from 3,243,173 passengers. The returns, however, show a material increase over those for the last quarter, when street railway traffic was so badly affected by the strike on the Transit Company's lines.

ST. LOUIS, MO.—A bill has been introduced in Council to authorize the Labor Union Street Railway Company to construct an electric railway over a specified route. The petitioners agree to begin construction within six months after the passage of the ordinance, and to complete the system within three years. Provision is also made for recompense of the city for the grant.

BUTTE, MONT.—The new power house and car house of the Butte Consolidated Street Railway on Montana Street is practically completed. The

building cost about $65,000, and replaces the old power house and car house of the company. The latter was dismantled piecemeal, and the new building was constructed so that the operation of the plant was at no time impaired. Forty-five cars can be stored in the new car house.

NASHUA, N. H.—At the annual meeting of the stockholders of the Nashua Street Railway Company, held Oct. 10, the following directors were elected: John A. Fisher, Fred C. Anderson, John P. Goggin, of Nashua, N. H.; P. F. Sullivan, of Lowell, Mass.; Joseph H. Goodspeed, of Boston. The directors organized by electing the following officers: J. A. Fisher, president; F. C. Anderson, vice-president; J. H. Goodspeed, treasurer; J. P. Goggin, assistant treasurer.

EXETER, N. H.—At the annual meeting of the stockholders of the Exeter, Hampton & Amesbury Street Railway Company, held Oct. 9, the following directors were elected: Warren Brown, Ebner Folsom, William Burlingame, Rufus N. Elwell, Albert E. McReel, Wallace D. Lovell and Edwin L. Pride. At a subsequent meeting of the board the following officers were elected: Warren Brown, president; E. L. Pride, treasurer; Harry E. Stone, assistant treasurer; John Templeton, clerk. The company's report for the year ending July 1, 1900, showed the gross earnings to be $75,029.75, with a surplus on hand of $17,755. The company will ask the Legislature for the right to build a line from Exeter to Newmarket, and possibly to Nottingham, Northwood and Lee.

NEWARK, N. J.—The street car coupon sharps are operating here. The plan is the same as that employed in Philadelphia, Chicago, Pittsburgh and other cities, and previously described in the STREET RAILWAY JOURNAL.

NEW YORK, N. Y.—Both cables on the lower section of the Broadway line of the Metropolitan Street Railway Company broke Oct. 9, and the cars were blocked from about 3 p. m. until 9 p. m.

ROME, N. Y.—The Rome City Street Railway Company has been granted a franchise to extend its lines along Madison Street to Maple Street and over Maple to James and down James to Garden Street. The franchise was granted on the same lines which have governed the franchises which have heretofore been granted the road.

BROOKLYN, N. Y.—A trackman of the Brooklyn Rapid Transit Company was killed Oct. 9 by coming in contact with the third rail on the company's elevated system.

GLENS FALLS, N. Y.—The Warren County Railway Company has recently been granted franchise for the construction of its proposed road in Warrensburg and Caldwell. The company has made application to the Council of Glens Falls for a franchise, and a hearing will be given Oct. 29.

EAST LIVERPOOL, OHIO.—E. S. Ranney, of Cleveland, and T. R. Andrews, of East Liverpool, are projecting an electric railway to extend from East Liverpool to Lisbon, and possibly to Salem. The route is being surveyed.

COLUMBUS, OHIO.—The Urbana, Mechanicsburg & Columbus Electric Railway Company has changed its plans for entrance into the center of the city. The new route is on Dublin Avenue to Dennison Avenue to Spring Street to Water Street to the interurban loop. The new route is considerably shorter than the route originally planned.

TOLEDO, OHIO.—Judge Barber has dissolved the temporary injunction restraining the Toledo Traction Company from extending its line on Stickney Avenue to meet the interurban road to Detroit. The Mayor has refused to sign the Stickney Avenue franchise ordinance, and it will pass over his head and become a law in a few days.

YOUNGSTOWN, OHIO.—A very handsome parlor car has just been constructed at the local shops of the Mahoning Valley Railway Company for General Manager Anderson, of the company. It was designed and constructed under the personal supervision of Superintendent Beatty, of the company.

TOLEDO, OHIO.—At the annual meeting of the Toledo Traction Company, held here a few days ago, the following directors were elected. Albion E. Lang, Norman B. Ream, John B. Dennis, James A. Blair, George W. Hale, W. B. Hale, Barton Smith, Rufus B. Baker, Thomas H. McLean, W. H. McLellan, Titus B. Terry. The old officers were re-elected as follows: A. E. Lang, president; T. H. McLeon, vice-president, manager and purchasing agent; B. Smith, secretary; J. B. Dennis, treasurer; J. F. Collins, superintendent.

TOLEDO, OHIO.—The Shore Acres Company, represented by Otto K. Schemansky, Julian T. Cockerille and Clarence D. Briggs, of this city, has just been granted a franchise for the construction of an electric railway from Casino to Point Place. By the terms of the franchise the road must be in operation in eighteen months. The grantees of the franchise now own considerable property at Point Place, and it is their intention to develop this and lay out a park. The new line will connect with the lines of the Toledo Traction Company at Casino.

MARIETTA, OHIO.—The Zanesville, Marietta & Parkersburg Traction Company is now being organized to construct an electric railway to connect Zanesville, Marietta and Parkersburg. The line will be built from Zanesville and follow the river to Duncan Falls. From here it will pass through the rich coal fields, a few miles back. The general course will be from Duncan's Falls to Relief, above Beverly; thence to Center Bend; from there through Watertown to Parkersburg. This will necessitate a spur from McConnelsville back a distance of 12 miles, and from Beverly a main line run to Marietta on the east side of the river. This will make a road of 95 miles, the main line being 63 miles, the McConnelsville line 12 miles, and the Marietta line 20 miles. The company proposes to construct three power stations at Beverly, McConnelsville and Duncan Falls.

COLUMBUS, OHIO.—The franchise of the Chillicothe, Mount Sterling & Columbus Electric Railway has been annulled by the County Commissioners and all rights heretofore given the company have been declared forfeited. It is stated that the company will not abandon the line, but that it will continue completing its plans and make application for a new franchise in the spring. I. S. Cook, of Chillicothe, is president of the company.

TOLEDO, OHIO.—At the annual meeting of the stockholders of the Toledo Traction Company, held last week, the following officers and directors were elected for the ensuing year: Directors, Albion E. Lang, Norman B. Ream, John B. Dennis, James A. Blair, W. B. Hale, Barton Smith, Rufus B. Baker, Thomas H. McLean, W. H. McLellan, Titus B. Terry and George W. Hale. The officers were re-elected as follows: Albion E. Lang, president; Thomas H. McLean, vice-president and general manager; J. B. Dennis, treasurer; Barton Smith, secretary.

AKRON, OHIO.—The Northern Ohio Traction Company has been granted a franchise for an extension of its local West Market Street line from Kuder Avenue to the corporation line.

BOWLING GREEN, OHIO.—Local people have commenced the work of securing a right of way for an electric railway from Fremont to Bryan, passing through Bowling Green, Napoleon and numerous small villages. The road would be practically an air line, connecting the county seats of four prosperous counties.

LORAIN, OHIO.—The Cleveland, Elyria & Western Electric Railway Company and the Sandusky & Interurban Railway Company have settled differences as to the ownership of track on a street where both had a franchise. The latter company will own the track, the former paying rental. Work of connecting the lines has been started, and the Cleveland, Elyria & Western cars will be running into town in a few days.

SPRINGFIELD, OHIO.—The Springfield Railway Company has amicably adjusted differences existing with motormen and conductors. A nine-hour schedule has been agreed upon, but the rate of wages remains unchanged.

CLEVELAND, OHIO.—The Railway Construction Company has been incorporated by Frank H. Ginn, Allison J. Thompson, V. F. Buhnard, John M. Garfield and Frank M. Cobb, to construct and equip electric and steam railways. The capital stock of the company is $10,000.

ALLIANCE, OHIO.—H. W. Klein, J. C. Whitla and H. M. Estep, of Pittsburgh, who are interested in the Alliance, Sebring & Salem Electric Railway, were here a few days ago in the interests of the project. While no official information was given out regarding the new line, it was learned that arrangements have been made for beginning construction work at an early date, and that the purchase of the power plant of the Alliance Gas & Electric Company is contemplated.

TOLEDO, OHIO.—The Toledo Interurban Railway Company was incorporated Oct. 13, with a capital stock of $100,000, to build an electric railway from Toledo through Lucas, Fulton and Williams counties, crossing the State line into Indiana. The route in Indiana is not described in the Ohio corporation papers. The incorporators of the company are: Grant Williams, Charles L. Reynolds, S. D. Carr, George D. Palmer, Jr., and James J. Robinson, of Toledo.

LISBON, OHIO.—Harry E. Foltz, of Chicago, has made application to the Council for a twenty-five-year franchise for the construction of an electric railway here.

TOLEDO, OHIO.—The promoters of the Toledo & Western electric road, which is to extend from this place to Morenci, Mich., with a branch line to Adrian, have completed the work of securing right of way. About half of the road will be built over private right of way. Contracts have been let to the Cambria Steel Company for rails, the first to be delivered Nov. 1. Among those interested in the company are: Luther Allen, Judge Carlos M. Stone, Francis C. McMillen, Stewart W. Chisholm and H. J. Hayes, of Cleveland.

CLEVELAND, OHIO.—It is reported that the Cleveland Electric Railway Company and the Cleveland City Railway Company will make no further attempts to secure the passage of a new franchise ordinance by the present Council.

FREMONT, OHIO.—At the annual meeting of the stockholders of the Toledo, Fremont & Norwalk Electric Railway Company, held last week, officers were elected as follows: S. F. Angus, president; W. B. Comstock, vice-president; A. W. Comstock, treasurer; W. A. Comstock, secretary.

COLUMBUS, OHIO.—The Columbus Railway Company has made application to the County Commissioners for permission to construct an electric railway to Arlington.

BRIGHTON, OHIO.—C. T. McCrea, of College Hill, is interested in a plan to construct an electric railway from Brighton to Cumminsville. It is announced that the necessary right of way has been secured for the construction of the line.

WASHINGTON, PA.—W. I. Berryman, of Pittsburgh, Pa., has submitted a proposition to the Council for the construction of an electric railway from Washington to Charleroi. Two routes are under consideration, and the length of the line will be about 25 miles. Mr. Berryman says that he has unlimited financial backing.

SHAMOKIN, PA.—The Shamokin & Mt. Carmel Electric Railway Company has increased the wages of the motormen and conductors in its employ from 12 to 15 cents an hour.

PHILADELPHIA, PA.—Four persons were injured as a result of a collision between a Columbia Avenue and Girard Avenue car of the Union Traction Company, Oct. 9.

MARSHALL, TEX.—A. W. Wheeler has applied to the City Council for a franchise for the construction of an electric railway here. Mr. Wheeler desires a fifty-year grant.

MONTPELIER, VT.—A bill has been introduced in the Legislature for the incorporation of the Granville & Poultney Electric Railroad Company. It is said that the new company will be an auxiliary of the recently incorporated Granville & Whitehall Railway, of Granville, N. Y.

Street Railway Journal

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Proceedings of the Nineteenth Annual Convention

OF THE

AMERICAN STREET RAILWAY ASSOCIATION

HELD AT

Kansas City, Mo., October 16-19, 1900

The nineteenth annual meeting of the American Street Railway Association was held at Convention Hall, Kansas City, Mo., Oct. 16-19, 1900.

TUESDAY'S SESSION

President John M. Roach, of Chicago, Ill., called the meeting to order at 11:15 a. m.

THE PRESIDENT.—We have a distinguished citizen of this city with us this morning and he will extend a welcome to you. I take great pleasure in introducing to you His Honor, James A. Reed, Mayor of Kansas City. (Applause.)

Mayor Read then delivered an address, and said in part: "Kansas City, as much as any other city in the world, welcomes to her midst the representative business men of all other cities. We believe out here in the West that it takes capital and brains and courage to build cities. We know out here in the West that if capital comes to us it must come because it expects a fair remuneration. And I want to call your attention, gentlemen, to the fact that you are in Missouri; and, notwithstanding the fact that nearly all of the States that surround us, when hard financial conditions existed, placed upon their statute books laws aimed at the destruction of wealth of financial institutions, there never has been a syllable, line or sentence of what we commonly denominate crank legislation placed upon the statute books of Missouri. (Applause.)

"We believe here in this State that capital should receive its fair share of remuneration; but we believe, at the same time, of course, that these great institutions which you represent owe some duties to the citizens of the cities, and that it is their business and duty to serve the citizens, and serve them well. While we believe in that, we, at the same time, realize the fact that great financial institutions must be secure in their profits, and that all the people have the right to ask of them is a policy of 'Live and let live,' of serving the people and in turn of being benefited by the people.

"We believe in inviting the capital of the East here for the purpose of investing in great public buildings. I do not believe a single man lives who came to Kansas City and used ordinarily good business judgment in the matter of his investment in great public buildings, but to-day is receiving splendid dividends upon that investment."

PRESIDENT ROACH.—Mr. Mayor, on behalf of the association, I desire to thank you for your eloquent words of welcome spoken to us, and also to give you my personal thanks. The first business of this meeting is the calling of the roll. If it is the pleasure of the meeting, instead of taking time to call the roll, the official registration of the secretary will be deemed the calling of the roll. That has been the custom in the past, and will be considered as applying at this time, if there is no objection. The next business before the meeting is the address of the president.

President Roach then read the following address:

PRESIDENT'S ADDRESS.

It gives me great pleasure to meet with you in this magnificent Western city. I have every assurance that nothing will be left undone to make our visit most pleasant and profitable. There is a breadth of character and freedom of personality in this young metropolis of the plains which peculiarly appeals to the business man who has large interests entrusted to his care, and I believe the members of this association will show their appreciation of the many pleasant things provided for their entertainment while in this community. When this nineteenth annual convention of the American Street Railway Association shall have finished its labors I am sure I may safely say to Mayor Reed that none of you will have regretted the acceptance of the hospitality of the people of Kansas City, so graciously extended by him.

I see before me representative men from all the leading cities of this country. To your hands are entrusted street railway investments aggregating hundreds of millions of dollars, and the welfare of over a million persons. From the single track, one-horse car of forty years ago the business in which you are engaged has grown to a magnificence where nearly all fields of human endeavor are called upon to perfect its equipment or aid in its management. It has outgrown ridicule and financial instability, and in the rapid whirl of events has built cities, enriched its promoters and made possible a freer, healthier and happier life for its patrons. Each day the street car is entering more and more into the business life and pleasures of the community, and each day its benefits are becoming more apparent to the general public.

The street railways of America now represent the enormous investment in bonds and stocks of $1,800,000,000, upon which investors are receiving annually over $70,000,000 in dividends and interest. Salaries and wages amounting to $250,000,000 a year are distributed among the three hundred thousand employees necessary to equip, operate and manage this great industry, repair its 20,000 miles of track, handle its 60,000 cars, and meet the ever pressing demands for improvement. Directly and indirectly over 1,200,000 persons depend upon the traction interests of America for their livelihood.

An industry of such proportions penetrates and more or less affects all other enterprises in the country which sustains it. Nine-tenths of the business men and women of the United States look to the management of street railway companies to furnish them with swift, comfortable and safe transportation to and from busi-

ness. Still a greater per cent of pleasure seekers demand and receive from the same management to and from theater, casino, park and suburb transportation of such elegance of equipment and efficiency in service as to satisfy the most exacting. It has required heroism and patience on the part of street railway men, with so little friction, to meet the demands of a critical patronage in so excellent a manner as is being accomplished by them at the present time.

On all sides we hear the cry of improvement, and in every direction we hear the sound of the busy car shop as it responds to the demand for more modern equipment. The public is becoming more exacting, and there is need for the most perfect knowledge and the widest experience to successfully cope with the ever changing situations which confront the street railway manager. Street railway companies have frequently, at great cost, increased their miles of tracks, and added to an expensive equipment, primarily for the sole purpose of accommodating the public, by penetrating into outlying districts, unwarranted by additional business to be acquired in such territory. This policy has proved wise in nearly every instance. It requires considerable pluck on the part of a company to back a temporary loss in order to please its patrons. Those companies which have pursued such a course have generally been rewarded by more liberality on the part of municipalities, more good nature and praise from patrons, and an early increase in the new districts acquired, which soon brought those lines to a paying basis.

In thus catering to the wishes of the public the street railway industry of the United States has been brought to a high standard of excellence, and has kept safely in advance of traffic. The aggregate of miles of track has grown from a few hundred miles of single track, confined mainly to business centers, to many thousands of miles of thoroughly equipped double tracks, which have brought the country districts within quick and active touch with the larger cities. Such energy and management must and will be appreciated and fairly treated by the communities benefited.

It may be declared that corporations are without soul, but it cannot truthfully be said that street railway corporations are lacking in good sense or business principles. False economic doctrines yield to and flee before rapid development and prosperity. A well equipped street railway with modern service, which seeks to oblige the people, operated in any community, will develop the best resources thereof and bring prosperity to its people with such rapidity as to utterly confuse and put to flight all false economic doctrines.

Newspapers, reviews, magazines, periodicals and journals of this country, indeed of many parts of the world, are entitled to the thanks of this association for the fair and generous treatment accorded in their columns to the street railway men and their interests during the year. It is the province of these publications to exploit the great industries of the land. If upon one day we are able to congratulate ourselves upon their unstinted praise, we should patiently bear the publicity of our faults, if any there be, in the next issue.

The last year has been a period of notable activity and healthy progress, with but few disturbances of a serious nature. The managers of large street railway properties should shape their policy toward their employees and the public so that disturbances between employer and employee will be entirely eliminated from their history. The management of the great corporations of the country can best retain the adherence and loyalty of employees by adopting toward them a policy at all times just, and at the same time courteous, kind and conciliatory. The good-will of your employees and of your patrons will be found an asset of great value in the days of trouble, and most desirable at all times.

A business so widespread in its usefulness, holding and judiciously employing, as it does, so great a portion of the capital of the country, and so essential to the best interests and prosperity of the trade centers, should, and I believe in good time will, possess the very necessary good-will and hearty support of the municipalities it so faithfully serves. Our interests and those of the public are inseparably interwoven, and naturally harmonious. If such interests become strained and in conflict such conditions are unnatural and illogical, therefore it should become one of the leading features of our association to suggest a uniform policy for street railway companies, of so broad a gage that the mutuality of the best interests of the public and of the company shall be as apparent to the people as to the street railway managers themselves.

I take pride in announcing that the condition of your association, both as to membership and finances, is improving each year. I wish to urge you to make this gathering of use to our association and of importance to the street railway industry. This may be accomplished by a full attendance upon and participation in the business meetings. The executive committee has selected members who have prepared papers on important subjects, and I urge upon you the advisability of entering into full discussions and analysis of these subjects, so that a clear understanding of all questions presented may be carried home with you. I also urge the association to show appreciation for our friends, the supply men, who have produced for this annual meeting their splendid exhibit.

Allow me to request your hearty support in the work of the Accountants' Association, which meets in annual convention here at this time. Its work is of great importance, and is worthy of your most serious consideration.

To the secretary and members of the executive committee our thanks are due for the satisfactory manner in which they have assisted in conducting the affairs of this association. Personally their efforts have been highly appreciated.

The honor of having acted as your president for the last year has been most gratifying to me, and shall ever remain one of the pleasant recollections of my life as a street railway man. For my successor I bespeak the same courtesy and cordial co-operation which it has been my good fortune to enjoy. Gentlemen, I thank you.

The President.—The next business in order is the report of the executive committee.

Secretary Penington read the report of the executive committee. It consisted of the minutes of the meetings of the committee on Feb. 5-8 and Oct. 15, and related principally to the making of the necessary arrangement for the use of the hall, rules for exhibitors, etc. Upon motion the report was adopted as read.

The President.—We will now hear the report of the secretary and treasurer.

The secretary read the following report:

REPORT OF THE SECRETARY AND TREASURER.

Cash in bank Oct. 10, 1899		$5,658.87
RECEIPTS TO OCT. 10, 1900		
Annual dues	$3,950.00	
Membership fees	250.00	
Space, Exhibit Hall, 1899	2,171.30	
Space, Exhibit Hall, 1900	47.00	
Interest on deposits	146.25	$6,564.55
		$12,223.42
EXPENSES TO OCT. 10, 1900		
Printing and stationery	$948.02	
Postage	162.00	
Salaries	1,500.00	
Miscellaneous expenses	50.00	
Executive committee, 1900	653.26	
Eighteenth Annual Convention, 1899	1,596.96	
Nineteenth Annual Convention, 1900	312.43	$5,222.67
Cash in bank Oct. 10, 1900		$7,000.75
		$12,223.42

October, 1895, $5,000 in debt.
October, 1900, $7,000 in bank.

MEMBERSHIP

Oct. 11, 1899		165
Members since last meeting		32
		197
LOSS		
Suspended	3	
Withdrawn	31	34
Membership Oct. 10, 1900		163

NEW MEMBERS

The following companies acquired membership at and since the last meeting:

Atchison, Kan.—Atchison Railway, Light & Power Company.
Aurora, Ill.—Aurora Street Railway Company.
Asbury Park, N. Y.—Atlantic Coast Railroad Company.
Bridgeton, N. J.—Bridgeton & Millville Traction Company.
Chicago, Ill.—Chicago Electric Traction Company.
Columbia, Pa.—Conestoga Traction Company.
Detroit, Mich.—Detroit & Pontiac Railway Company.
Dayton, Ohio.—Dayton & Western Traction Company.

Elgin, Ill.—Elgin City, Carpenterville & Aurora Street Railway Company.
Fond du Lac, Wis.—Fond du Lac Street Railway & Light Company.
Ft. Wayne, Ind.—Ft. Wayne Traction Company.
Galesburg, Ill.—Galesburg Electric Motor & Power Company.
Hamilton, Ohio.—Cincinnati & Hamilton Electric Street Railway Company.
Highwood, Ill.—Chicago & Milwaukee Electric Railway Company.
Joliet, Ill.—Joliet Railway Company.
Kansas City, Mo.—East Side Electric Railway Company.
Knoxville, Tenn.—Knoxville Traction Company.
Montreal, Canada.—Montreal Street Railway Company.
Oakland, Cal.—Oakland Transit Company.
Pasadena, Cal.—Los Angeles & Pasadena Electric Railway Company.
Pittsburgh, Pa.—Consolidated Traction Company.
Peoria, Ill.—Peoria & Pekin Terminal Railway Company.
Pueblo, Col.—Pueblo Traction & Electric Company.
Schenectady, N. Y.—Schenectady Railway Company.
Sioux City, Ia.—Sioux City Traction Company.
St. Louis, Mo.—St. Louis Transit Company.
Seattle, Wash.—Seattle Electric Company.
South Bend, Ind.—Indiana Railway Company.
Vicksburg, Miss.—Vicksburg Railroad, Power & Light Company.
Venice, Ill.—Venice, Madison & Granite City Railway Company.
Willoughby, Ohio.—Cleveland, Painesville & Eastern Railroad Company.
Westwood, Mass.—Norfolk Western Street Railway Company.

MEMBERS SUSPENDED

The following members were suspended for non-payment of dues:
Newburyport, Mass.—Newburyport & Amesbury Street Railway Company.
Steelton, Pa.—Middletown, Highspire & Steelton Railway Company.
West Superior, Wis.—Superior Rapid Transit Railway Company.

MEMBERS WITHDRAWN

The following members have withdrawn during the past year, in nearly every case owing to consolidations:
Atlanta, Ga.—Atlanta Railway Company.
Baltimore, Md.—Baltimore City Passenger Railway Company.
Buffalo, N. Y.—Buffalo Traction Company.
Bridgewater, Mass.—Brockton, Bridgewater & Taunton Street Railway Company.
Cleveland, Ohio.—Akron, Bedford & Cleveland Railway Company.
Covington, Ky.—South Covington & Cincinnati Street Railway Company.
Detroit, Mich.—Wyandotte & Detroit River Railway Company.
Denver, Col.—Denver City Railway Company.
Derby, Conn.—Derby Street Railway Company.
Gloucester, Mass.—Gloucester Street Railway Company.
Girardvillle, Pa.—Schuylkill Traction Company.
Manchester, N. H.—Manchester Street Railway Company.
New Britain, Conn.—Connecticut Lighting & Power Company.
Norwalk, Conn.—Connecticut Lighting & Power Company.
Niagara Falls, N. Y.—Niagara Falls & Suspension Bridge Railway Company.
North Tonawanda, N. Y.—Buffalo & Niagara Falls Electric Railway Company.
New York, N. Y.—Nassau Electric Railroad Company.
Paterson, N. J.—Paterson Railway Company.
Pueblo, Col.—Pueblo Traction Company.
Racine, Wis.—Belle City Railway Company.
St. Louis, Mo.—Cass Avenue & Fair Grounds Railway Company.
St. Louis, Mo.—Citizens' Railway Company.
Lindell Railway Company.
Missouri Railroad Company.
Southern Electric Railroad Company.
St. Louis Railroad Company.
Union Depot Railroad Company.
Taunton, Mass.—Taunton Street Railway Company.
Taunton, Mass.—Providence & Taunton Street Railway Company.
Wakefield, Mass.—Mystic Valley Street Railway Company.
Wakefield, Mass.—Wakefield & Stoneham Street Railway Company.

DEATHS DURING THE YEAR

Philip T. Begley, superintendent, Lowell & Suburban Street Railway Company, Lowell, Mass.....Dec. 24, 1899
Amos Breed, president, Lynn & Boston Railroad Company, Lynn, Mass.....May 22, 1900
Garrett A. Hobart, president, Paterson Railway Company, Paterson, N. J.....Nov. 21, 1899
John McNulta, receiver, Calumet Electric Street Railway Company, Chicago, Ill.....Feb. 22, 1900
Volney C. Turner, ex-president, North Chicago Street Railway Company, Chicago, Ill.....Dec. 2, 1899
J. H. Vander Veer, superintendent motive equipment, Brooklyn Heights Railroad Company, Brooklyn, N. Y...Dec. 3, 1899

Upon motion the report was received and placed on file.

The secretary then announced that the Kansas City Club and the Elks Club had extended a cordial invitation to all the delegates to visit their clubrooms.

THE PRESIDENT.—The next business before the convention will be the reading of a paper by Mr. Daniel B. Holmes, counsel of the Metropolitan Street Railway Company, Kansas City, Mo., on the subject "Consolidation of Street Railways and Its Effect Upon the Public." [This paper is published elsewhere in this issue.]

THE PRESIDENT.—We would be glad if anyone has anything to say to hear from him. I imagine the gentleman has treated the matter so comprehensively and in such a diplomatic manner there is very little additional that can be said.

The secretary announced that there would be a reception held Monday evening, at 8:30 o'clock, at the Midland Hotel, at which all the delegates and others in attendance upon the convention were invited to be present. That on Wednesday at 2 P. M. there would be a trip to Armour's packing house, and in the evening a theater party at the Coates' Theater.

The meeting then adjourned.

WEDNESDAY'S SESSION

President Roach called the meeting to order at 10:50 o'clock a. m.

THE PRESIDENT.—For reasons unnecessary to explain at this time, we have changed the order of business somewhat. The names of the nominating committee have been selected, and the secretary will now read them. This committee will also recommend to the association a place for our next meeting.

The secretary read the names of the committee on nominations as follows: Chairman, John A. Rigg, Reading, Pa.; E. C. Foster, Lynn, Mass.; E. G. Connette, Syracuse, N. Y.; D. B. Dyer, Augusta, Ga., and Robert McCulloch, Chicago, Ill.

THE PRESIDENT.—I would say to the gentlemen who have any idea of asking the association to hold its next meeting in their city, that they can see Mr. Rigg, the chairman of the committee on nominations, any time at their convenience. Mr. Rigg will appoint a time and place for the meeting of the committee.

SECRETARY PENINGTON.—Mr. President, I will state that I have received invitations from the Mayor of Cincinnati, the president of the Cincinnati League, and from President Kilgour, of the Cincinnati Street Railway Company, asking us to hold the next convention in that city. I will turn these invitations over to Mr. Rigg, chairman of the committee.

THE PRESIDENT.—The next order of business is the reading of papers. The first paper on the programme this morning is entitled "A Comparison of the Various Systems of Electrical Distribution for Street Railways," by C. F. Bancroft, electrical engineer Massachusetts Electric Companies, Boston, Mass. Mr. Bancroft is not in attend-

ance at the meeting, and it will devolve upon the secretary to read the paper.

The secretary read the paper, which will be found elsewhere in this issue.

The President.—We would be pleased to hear from some of the gentlemen who are present in reference to the subject matter of this paper. I will call upon E. C. Foster, of Lynn, to open the discussion on this paper.

Mr. Foster.—Mr. President and gentlemen, I thank you for calling upon me, but as I am not an expert electrician, it seems to me that I am hardly competent to discuss the merits of the paper which has been read. I think that Mr. Bancroft has treated the subject in a very broad way. He is a very competent man, and is employed by the same companies which employ me. We consider him one of the ablest electrical engineers in the East. I do not care to undertake to discuss this subject. There are many others here far more competent to do it than I, and I should be pleased to hear from Colonel Heft. I thank you for calling upon me, Mr. President.

The President.—Is Colonel Heft in the room? If so we would be pleased to hear from him. As Mr. Heft is not present, I will call upon E. G. Connette, of Syracuse, N. Y., to give us his views upon the subject.

Mr. Connette.—I thank you, Mr. President, but I think, like Mr. Foster, that the paper is of such a technical nature, and the ground has been so fully covered, that there is nothing that can be said which would be interesting in addition to what the author has already stated.

The President.—I can fully appreciate what the gentlemen have said, after listening to the paper. It certainly seems to cover the ground quite fully. We would like to hear from Colonel Dyer, of Augusta, Ga.

Mr. Dyer.—Gentlemen of the convention, I am not at all prepared to discuss a technical paper of this character. I think that the subject has been treated most exhaustively, and it is a valuable paper. This association certainly owes a debt of thanks to the gentleman who wrote it. I am wholly unable, however, to go into the details of the paper and discuss the advantages of the different systems which have been referred to.

Mr. Connette.—Mr. President, I would suggest, if you will permit me, that we hear from Charles W. Wason, of Cleveland.

Mr. Wason.—Mr. President and gentlemen of the convention, it seems to me that from the standpoint from which the author of the paper has taken up the subject there is very little to discuss as to applying the theories of the paper to any particular road. The fact that the condition of each road, as it is presented, determines in a great measure the character of the electrical application, there really is hardly anything that we can discuss. If we had a road which we desired to equip, then the question would come up as to which one of the several systems presented would, in the minds of the gentlemen present, be competent to bring out the best results. Under the circumstances, it does not seem to me that there is really anything to discuss.

Mr. Connette,—I move that the paper be received and the thanks of the convention tendered to the author. Motion carried.

The President.—The next regular order of business is the reading of the paper on "Painting, Repainting and Maintenance of Car Bodies," by F. T. C. Brydges, superintendent of car shops Chicago Union Traction Company, Chicago, Ill.

The secretary read the paper, which will be found elsewhere in this issue.

Mr. Harrington.—I have prepared some statements of the cost of the various kinds of painting we have done. I made some statements last year at the meeting which seem to be rather low in price. I have prepared these figures from work actually done and took five different operations, took them from our detailed sheet. For instance, the first-class operation, which was for an 18-ft. car body, including the entire repainting of the car, the roof and the trucks, under the contract price, piece-work system, the cost was $28 for labor and $19.79 for material, the total cost being $47.79. I have here, which I will hand to the secretary, a detailed statement showing the various operations and the material entering into them. On a second-class operation, same work, on a 16-ft. car body, the total cost was practically the same. On a third-class operation, a $14 contract cutting in of paint work, varnishing, etc., the total cost was $24.21, the material being $10.21. The fourth-class operation was outside painting of vestibules and cutting in dashers, touching up main body, blacking off iron work, one coat of finishing varnish, one coat of paint on roof, dashers, floors and platforms and one inside coat of finishing varnish. The contract price for this work was $8.50, and the materials $7.71, making a total of $16.21. The simplest operation is probably the fifth-class operation, outside touching up dashers and main body of car, outside blacking off of iron work, one coat of outside finishing varnish, one coat of roof paint and one coat of paint on inside of dashers, floors and platform. The contract price for this work is $4, and the material $5.13, making a total of $9.13 as an average. This work is done on the piece-work system. Under the usual system of hiring labor, we usually found our work cost in labor 50 per cent to 100 per cent more than under the piece-work system. I have taken these figures from our books, and have had some talk on the subject with other street railway managers, and they think that the figures are very satisfactory.

Mr. Foster.—I would ask through you, Mr. President, the price paid by Mr. Harrington for the labor in doing that contract work?

Mr. Harrington.—Twenty-five cents an hour for the painter. The assistant painter gets 15 cents an hour.

Mr. Rigg, of Reading.—I move that the paper be received and the thanks of the association be extended to Mr. Brydges. Carried.

The secretary announced that a trip would be made to Armour packing house at 2 o'clock Wednesday afternoon, and there would be a theater party in the evening at the Coates' Theater, and that on Friday at the Convention Hall there would be a vaudeville entertainment, provided by the supply men.

The meeting then adjourned until 11 o'clock Thursday morning.

THURSDAY'S SESSION

President Roach called the meeting to order at 11:10 a. m.

Secretary Penington.—I wish to announce that seventeen companies have joined the association at this meeting:

Dallas Consolidated Electric Street Railway Company, Dallas, Tex.
Danville Street Railway & Light Company, Danville, Ill.
Detroit, Rochester, Romeo & Lake Orion Railway Company, Detroit, Mich.
Jackson Railway, Light & Power Company, Jackson, Miss.
Kansas City-Leavenworth Railway Company, Kansas City, Kan.
East Side Electric Railway Company, Kansas City, Mo.
Lebanon Valley Street Railway Company, Lebanon, Pa.
Meridian Street Railroad & Power Company, Meridian, Miss.
Schuylkill Traction Company, Norristown, Pa.
Hoosac Valley Street Railway Company, North Adams, Mass.
Ottawa Railway, Light & Power Company, Ottawa, Ill.

Ottawa Electric Railway Company, Ottawa, Ont.
Holmesburg, Taconey & Frankfort Electric Railway Company, Philadelphia, Pa.
Monongahela Street Railway Company, Pittsburgh, Pa.
Rockford Railway, Light & Power Company, Rockford, Ill.
Saratoga Traction Company, Saratoga, N. Y.
Terre Haute Electric Company, Terre Haute, Ind.

THE PRESIDENT.—Gentlemen, we will now proceed to the regular order of business this morning. The paper on the programme is entitled "Double-Truck Cars: How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions." This paper is by N. H. Heft, president of the Meriden Street Railway Company, Meriden, Conn.

This paper will be published in an early issue.

THE PRESIDENT.—Gentlemen, we invite the members to come forward and inspect the plans prepared by Colonel Heft at considerable trouble and expense, showing the details of the construction of the car he has spoken of. (A number of the members then inspected the plans of the car.)

PRESIDENT ROACH.—I would state, gentlemen, for your information, that all of the cuts, as shown here, will appear in the minutes of the meeting, to be printed hereafter and distributed among the street railway men of the United States and Canada. I desire personally to thank Colonel Heft for his able paper, and we will be much pleased to hear it discussed by the members of the association. To start this discussion, I take pleasure in calling upon E. C. Foster, of Lynn, Mass.

MR. FOSTER.—I have listened with a great deal of interest to the paper read by Colonel Heft, and have also given a casual glance at the drawings submitted. I think that Colonel Heft is on the right line in the way of making improvements. We all know that it is desirable to have cars constructed as light in weight as possible, and yet to be sufficiently strong to meet all the requirements and conditions. I am very glad, Mr. Chairman, that Colonel Heft has taken up this subject. We all know that the varying conditions under which we operate in the various States and municipalities require different kinds of equipment. There are places, of course, on the interurban lines where an equipment designed similar to that submitted here could, without doubt, be operated very successfully. The Lynn & Boston Railroad Company, with which I am connected, for instance, is operating lines running into Boston. We have one line over a distance of 16 miles from a small town on the coast, Marblehead, through Swampscott, Lynn, Revere and Chelsea to Boston. On that line we are operating 12-bench double-truck open cars, equipped with four motors. The closed-car equipment consists of 25-ft. box cars with double trucks and four motors each. We have been operating over this line about fifteen months at a maximum speed of 30 miles an hour, and we have found by our experience that the operation of four motors is more economical than the operation of two motors over the same line under the same cars and under the same conditions. To be sure, there is an increased consumption of power. We are all willing, I believe, to concede that, and I think Colonel Heft will agree with me, although he shakes his head to the contrary. From tests made we are sure of it. The operation of four motors, of course, depends upon the speed you wish to attain, and that it is desirable to attain. In operating upon a line where your speed is not more than 12 miles to 15 miles per hour, I question whether it would be wise to adopt the practice of using four motors. We are also operating on many lines 16-ft., 18-ft. and 20-ft. cars. With those cars we use, as is customary, the usual two motors. We have various types of motors, but we have learned by our experience that the double-truck car, with two motors, or four motors, is more desirable and profitable to operate; and we are now rebuilding some of our smaller cars and converting them into 25-ft. cars. We are doing that successfully. We are also building a large number of new 25-ft. double-truck cars.

MR. CHAMBERLAIN, Brooklyn.—You will appreciate that the average mechanic in this country has his "hobbies," as well as the average professional man. Without referring to any part of the electrical equipment which Colonel Heft has designed for his peculiar class of cars, there are two or three innovations from the present practice in the construction of the car body which may well attract attention. With most of us, innovations of this character are subject to adverse criticism. I know of nobody who would be subject to adverse criticism less than the author of this paper, who has had such a vast amount of experience in this direction, and it seems that it is right and proper he should make an innovation of this character. I speak more particularly of the construction of a car without longitudinal truss rods. I think that Colonel Heft has designed a car of something over 42 ft. in length, and gains his body support by a number of cross transoms built in the form of the ordinary iron body bolster, welded at the ends, filled in with wood, and supported through the center with longitudinal I-beams running from one end of the car to the other. The author of the paper has evidently succeeded in obtaining the minimum of weight with the maximum carrying capacity, and I think, gentlemen, you who are practical men, and you certainly all appear to be, will agree with me that that is the object to be sought.

There are some questions I would like to ask Colonel Heft in private, and he has kindly invited me to inspect his cars when they are put on the road. One question I have in mind is with regard to what might be the result of an end collision. I do not know whether this truss, running longitudinally through the car from one end to the other, would be all that is adequate, and would perform the functions and give the proper camber to the car, that the ordinary longitudinal truss rods do. You will recollect some years ago that the managers of the steam roads went wild in following out the idea of reducing the weights of their rolling stock, until they reached a point where they almost passed the limit of safety factor. Colonel Heft advises me that he has carried through on this device a factor of safety sometimes reaching as high as 25 per cent. If he has done that he has certainly covered all the ground that is necessary to make the vehicle safe, and one that would do good service in actual practice. I was very careful to inquire of the Colonel whether he placed all his strength on a line with the sills. When we have a collision we do not collide with the clear story of the end of the bonnet, but we generally get it on the end of the buffer. Of course, we all know there are some roads which never have any accidents, and they do not have to experience any difficulties of that kind. I was particular to ask him whether the strength was on a line with the longitudinal timbers, and whether the frame above that included posts and trusses in the framing, and the clear story was lightened up correspondingly. It would be a difficult matter to put all of the strength in the clear story, or on a line with the roof, because when this is done and the car runs into any obstruction the roof would probably keep going on and the body remain where it was.

Not to occupy any more of the time of the meeting, I would like to ask the author of the paper whether he has sufficient strength with the transverse brace to overcome the difficulties which I have outlined?

MR. HEFT.—I will say, in reply to Mr. Chamberlain,

that I have endeavored to get all of the strength longitudinally, lightening the upper portion of the car, but constructing it in such a manner that the upper portion is braced to the lower portion and tied to it, both longitudinally, vertically and otherwise. I would say, for the information of the members, that we have under contract the construction of five of these cars. We expect that the first one will be turned out in from four to six weeks. We expect to operate this car from Port Chester, N. Y., to New Rochelle, N. Y. I would be very glad to show the car, when in operation, to any of the members of the association. I may be wrong in my ideas concerning this car, but we are putting up our own money to build it. If it is a failure, we will have to foot the bills. (Applause.)

W. E. Harrington, Camden.—The question of four-motor equipments seems to be one of a mooted character. There are a large number of roads using four-motor equipments, but there seems to be relatively very little known as to the number of watt-hours per car mile which the different equipments require, and with the idea of bringing out that point as a feature of discussion, I would like to place this question before the meeting: "What is the experience of those present, who have made tests, as to the watt-hours required by the different equipments mentioned?" Mr. Foster says it takes more power with the four-motor equipment, and Colonel Heft says it takes less. They are both highly representative men, and yet they differ on this point. Our road is about to place some equipment orders. I have been urging four-motor equipments, and yet I must confess I am somewhat in the dark as to the relative merits of the different equipments. [I know from tests I have made that the double-truck 40-ft. car equipment, with two 38-B Westinghouse motors, on maximum traction trucks, have taken an average of 2000 watt-hours per car mile, whereas the same weight of car, with the center pivotal truck, with No. 49 Westinghouse motors, 35-hp, under identically the same conditions, takes an average of only 1200 watt-hours per car mile. Again, a single-truck car, with an 18-ft. body and under similar conditions, takes an average of 900 watt-hours. I would like to know if there are any data from actual test to show the number of watt-hours consumed by these different equipments. I have made a series of tests on different classes of cars, showing the watt-hours. I deem this matter of very great interest, and I will file with the secretary a statement of the results secured in these tests. I did not encounter any difficulty in getting information of this character, and I think the information obtained by me would be interesting to the other members, in showing the number of watt-hours consumed per car mile with the various forms of equipment.

Mr. Heft.—In answer to the gentleman, I will say I have not the figures of the tests at hand, and do not remember the figures of the tests, but we have made a series of tests during the last three years with double-truck cars, equipped with one, two and four motors, as I have stated in the paper, and we have kept a very close and accurate record of the results. The weights of the different trains on which these tests were made varied from 15 tons to 250 tons. The speeds varied from 10 miles to 65 miles an hour.

There is no place where the car is operated with an increase of current with the four-motor equipment, except while accelerating, but you gain a quicker and higher acceleration by this increased consumption of power. The average consumption of the current, however, and even the total consumption of the current in the running of the cars, is less with the four-motor equipment than with the two-motor equipment. That is beyond dispute. I can furnish the data to that effect, and I think the General Electric Company and the Westinghouse Company, also, can furnish any of our members with data which will substantiate that statement. It is unquestionably correct.

Mr. Wason.—I would ask the writer of the paper if the additional cost for the drilling of the hole through the axle and the armature shaft is commensurate with the results, and whether he is seeking to lighten the axle, or to be assured of the quality of material?

Mr. Heft.—In reply to Mr. Wason, I will say that I am willing to admit that the drilling of the axle is a debatable question. About five years ago we commenced to use hollow axles on our high-speed motors, and the results have been so favorable in the way of lessening hot boxes, hot journal bearings, and everything of that kind, that we have decided to adopt that form of axle. It decreases the weight about 25 per cent, with a loss of strength, varying according to the size of the axle, of from only 3 per cent to 5 per cent. We have never had any of them break. We had a great deal of trouble with our axles on our heavy high-speed motors, and we found it necessary to increase the diameter and weight of the axles. We were loath to do this, and so we adopted the plan of drilling a hole through the axle to lighten it. We not only lighten the

Tests Made by W. H. Harrington, of Camden, on Watt-Hours per Car Mile with Different Equipments

Date	Car	Controller	Average Points	Resistance	Truck	Dia. Wheel: Large	Dia. Wheel: Pony	Wheel: Tread	Wheel: Base	Weight Wheel: With Axle: Large	Weight Wheel: With Axle: Small	Motor	HP	Average Watts	Average Volts	Average Amperes	Maximum Amperes	Full Speed	Time Using Current	Time Coasting	Between Haddonfield and Fed. St. Ferry, Up and Down	Time Start to Stop	Watt Hours Per Car Mile
Aug. 17	120	K-11	3.5	No. 3 West. Col.	St. Louis, Dble	33 in.	24 in.	2 in.	4 ft. 2 in.	1,125 lbs.	725 lbs.	2-38-B	50	24,250	495	50.8	185	70	27.4 min.	10.6	To ferry, 6.99	38 min.	2,092
" 17	"	"	4.8	" "	" "	33 "	24 "	2 "	4 " 2 "	1,125 "	725 "	" "	50	22,419	477.5	47.4	200	70	26.75 "	12.25	To Had., 7.35	39 "	1,845
" 21	134	K-10	5.2	G. E. 1-101, 1-102	Brill 27-G "	33 "	24 "	2 "	4 " 2 "	---------	------	2-No. 3 West.	30	17,719	470	37.7	160	60	31.75 "	10.5	To ferry, 6.99	42.25 "	1,690
" 21	"	"	4.8	"	" "	33 "	----	2 "	4 " 2 "	---------	------	" "	30	14,382	470	30.6	125	40	27.2 "	9.8	To ferry, 6.99	37 "	1,249
" 23	114	"	3.1	No. 3 West, Col.	" 21-C	33 "	----	2 "	6 " 6 "	900 lbs.	------	2-Walker No. 5	30	9,028	488	18.5	85	35	23 "	14	To ferry, 6.99	37 "	795
" 23	"	"	2.8	" "	" "	33 "	----	2 "	6 " 6 "	900 "	------	" "	30	7,986	493	16.2	40	37	27.4 "	14.6	To Had., 7.35	42 "	760
" 16	58	D	--	Davis West	Manier	33 "	----	2 "	6 " 6 "	950 "	------	1-No. 3 West.	30	7,055	538	13.3	60	--	--------	----	Mer. to C., 4.34 *	29.75 "	812
" 16	"	"	--	" "	" "	33 "	----	2 "	6 " 6 "	950 "	------	" "	30	13,494	519	26	60	--	--------	----	Bridge to C., 3.43 *	18 "	1,180
" 22	120	K-10	8.01	G. E. 2-1042, 1-102	Brill 27-G Dble	33 "	----	2 "	4 " 4 "	1,050 "	------	2-No. 49	35	15,357	451.7	34	125	60	31.4 min.	15.2	To Had., 7.35	47 "	1,479
" 22	"	"	2.8	" "	" "	33 "	----	2 "	4 " 4 "	1,050 "	------	" "	35	11,988	444	27	118	50	22 "	16	To ferry, 6.99	38 "	1,094
" 24	80	"	3.8	Westinghouse	" 21-E	33 "	----	2 "	7 " 7 "	1,050 "	------	2-No. 3 West.	30	9,541	470	20.3	80	33	27 "	13	To Had., 7.35	40 "	864
" 24	"	"	3.4	"	" "	33 "	----	2 "	7 " 7 "	1,050 "	------	" "	30	8,058	474	17	72	32	24.3 "	11.7	To ferry, 6.99	36 "	690
" 20	107	"	--	2-Westinghouse Col.	" 21-A	33 "	----	2 "	6 " 6 "	1,050 "	------	" "	30	9,086	488	17.8	65	33	22 "	14	To ferry, 6.99	36.5 "	781
" 20	"	"	3.2	" "	" "	33 "	----	2 "	6 " 6 "	1,050 "	------	" "	30	8,892	494	18	88	35	24.5 "	15.5	To Had., 7.35	40 "	804

axle, but we get the benefit of having a ventilated axle. It overcomes crystallization in the axle.

J. I. BEGGS, Milwaukee.—In connection with the statement that four motors take no more current than two motors, I would ask Colonel Heft whether he meant four motors of the same size, or two motors having the same capacity as the four might have had?

MR. HEFT.—We have made experiments with motors of different capacities, but all of the motors were of the same size, and used on the same class of equipment.

MR. BEGGS.—I do not know whether I made myself clear. We made some very exhaustive tests, and they were so opposed to the position which Colonel Heft now takes that I took occasion to have B. E. Sunny, the Western manager of the General Electric Company, and also Theodore P. Bailey, the manager of the railway department of the General Electric Company, of Chicago, to come and witness the tests made on this mooted question of the amount of current consumed by these different equipments. Of course, this matter is a very important one to all of us.

I might say that we adopted double-truck cars as a standard for our entire system five years ago. We have been using them ever since, and are continually increasing the number. We have given a great deal of attention to the development of the most advantageous car, the most durable car, the car which will best stand the strains to which Mr. Chamberlain referred, as ours is one of the roads that has collisions, and a number of them, unfortunately, and some pretty severe ones. We operate 350 miles of road, and have one electric line 61 miles in length. We try to build the equipment to that it will be interchangeable, in city use or in suburban service, as we have a consolidated system, and we run the cars interchangeably. I must take issue with Mr. Heft's statement to the effect that four motors do not take more current than two motors. If you equip a car with two G. E. 1000 motors, or four 1000 motors, I think any gentleman, when he comes to pay for the current, will pay for 20 per cent more current in the four motors than in the two motors; but he will get 50 per cent better service with the four motors. That has been our experience. Our cars for three years were equipped with two motors. For the past two years, after careful experimenting and taking into account the various costs entering into the matter, of which the smallest is power, we have adopted four motors as a standard, be they of whatever size they may. We can get much better results from 150 hp in four motors under a car than we can with 250 hp in two motors under the car. That is our experience. The results may differ in various sections of the country, but with us the four motors have certainly taken from 20 per cent to 25 per cent more current than the two motors, running under exactly similar conditions, not for the purpose of test, but putting them in regular service on long distance on city lines, with wattmeter, voltmeter and ammeter, so as to cover all the points. The use of these four motors is a very important thing on our standard car, which is 41 ft. over all, and seats forty-four passengers, with cross seats, and weighs somewhat heavier than the car referred to by Mr. Heft. I trust that Mr. Heft will succeed in making his car all that he desires.

I was very much interested in the points raised by Mr. Chamberlain, as we have found that, in order to put a car on the tracks in our city so that it will stay there, in spite of a head-on collision, as we sometimes have, even with the greatest degree of care, it requires some weight and strength to withstand the shock so that the car will not be absolutely shattered. We had a case recently with a green motorman on a curve, where our car was thrown off the tracks across the street, with result that the car was not much injured except that a corner post was knocked off. I think Colonel Heft has seen how our cars are braced. We use the longitudinal truss rod and truss plank, with a rod through it. We do not feel that we can take chances with the longitudinal brace; we want the strongest construction possible to put in the car. Therefore, I should take issue with Mr. Heft on that point.

As stated, the results of the tests made were somewhat contrary to what the experts had given us to believe we might expect would be as regards the power consumed. For that reason I had Mr. Sunny and Mr. Bailey come to Milwaukee on two or three different occasions to make those tests, not simply tests on a special car, but on the regular service, equipping different cars on our regular service with different types of motors—two G. E. 57, two G. E. 1000, and four G. E. 1000 under different cars. I do not believe there is any question that the four motors will take more current, but, as has been said, you get quicker acceleration. You have no slipping wheels. In our practice we are going to put two additional motors on all the cars we equip in the future. The higher speed you can make compensates for the increased power consumed. In the city service where we use these cars, as we do entirely, with blocks running from 200 ft. to 300 ft. in length, it is an important matter if you can save a second or two on each street corner in getting the car into rapid motion; and when the car gets on a slight grade, or starts on a slippery rail, it will immediately pick up speed and get off without spinning the wheels. That is what the four motors will do. I believe that four smaller motors are much more effective than perhaps 50 per cent increased capacity in two heavier motors. I give you my experience, gentlemen, for the reason that we have running some three hundred of these double-truck cars. We have one line which is 61 miles in length. We control all the city lines in Milwaukee and Racine, 25 miles south, and extending 35 miles south to the city of Waukesha. We have a complicated system, but it is run as one entire system. If we have a certain call for cars on any of our interurban lines, we can take our city cars for this purpose, because they are interchangeable.

To compete with the steam railroads we are now giving our attention to the development of a new car that will be 50 ft. over all, and upon which we propose to mount four motors of 75 hp each. The steam railroads throughout our Western country are beginning to realize they have a real competitor in electric lines in distances of 50 miles or 60 miles, and, as a consequence, they are reducing the rates of fare very materially and putting on an additional number of high-speed trains to run short distances. We propose to build an electric car for the double purpose of being able to make 60 miles an hour with four of these G. E. motors, and with the further purpose that in case we have a congestion of travel on any of the lines running to our summer resorts, we can hitch three or four trailers to the car and make 35 miles to 40 miles an hour, and handle a larger body of people at a much reduced cost. We may have peculiar conditions in our city, but that is one of the things we have in mind. With these cars which we are going to build, and under which we are to put four motors, we should want a more substantial construction than the cars shown in the drawings which have been submitted to us, although these cars may be all right for the service for which Mr. Heft designed them. I have given you the result of our experience in five years of operation with double-truck cars and four-motor equipments.

MR. HEFT.—I wish to say, in reply to Mr. Beggs, that his statement is true, judged by his conditions, while I also insist that my statement is true taken from my condi-

tions. Mr. Beggs' cars, I believe, are operated largely through city streets, and are frequently stopped and started; and, as I stated in reply to Mr. Foster, there would be a greater current consumption in producing the acceleration of the car when starting and stopping so often.

Mr. Beggs.—I might state, gentlemen, that this test was not made on a city line. It was made on our Waukesha line, a 20-mile road, with a train every hour each way. We make the run in fifty-two minutes, and keep up an hourly service with two cars. The test was made on that high-speed line, upon which there are very few stops, and sometimes no stops in a distance of 10 miles.

Mr. Heft.—Then I must insist, under that condition, that my statement is correct. (Laughter.) I will say, to satisfy Mr. Beggs, if he will come down to inspect our system, I will give him an opportunity to witness a test, and if he does not agree with me I will pay his expenses to Meriden and back.

Mr. Beggs.—It will be a pleasure and worth all the expense to spend a day with the Colonel, outside of the test; but I shall take advantage of the opportunity he offers to have this test made. I shall, however, want to know how his instruments are calibrated. I shall also want to take some expert along with me to see these tests. I am not an expert in electric railway matters, except on the commercial side; but I feel sure there is some mistake in the readings of the motors. I was told what the Colonel tells us, but it did not agree with my own practical experience, and what I considered would be the result when I was seriously considering three years ago, this very question of whether or not we could afford the current consumption required by four motors. The first report which came to me from a gentleman whom I considered to be a highly scientific, technical engineer, harmonized with what Colonel Heft has told us, and the report went further and said that four motors saved 10 per cent, and he submitted the figures to demonstrate it. Then I concluded I would call in other experts, and I did call in Mr. Sunny and Mr. Bailey, and I went on the cars myself with these gentlemen, and spent several days with them. The result was that I found it took fully from 20 per cent to 25 per cent more current with the four motors than with the two motors, on the same character of service, the same cars and load, and running exactly during the same hours, as we made the tests on different days, so as to get exactly the same conditions.

Mr. Foster.—As I understand it, the conditions under which Colonel Heft has been making tests are different from the ordinary conditions under which street railways operate. The conditions there are these: That the test was made upon a steam railroad roadbed, with stops at infrequent intervals; that is to say, that the run would be made from one station to another, a distance of two or three, or five, or even ten miles. That being so, I think it is possible that they do operate, as he says, without consuming a greater amount of current than they would with two motors. Our experience in operating four motors on the same type of car, over the same road, under the same conditions, as near as it is possible to obtain them, has been that it requires from 15 per cent to 23 per cent more current to operate four motors than two motors. We make tests twice a year, and pay for current on that basis, and we believe that the tests are carefully made, as they are conducted by the representatives of the Boston Elevated Railway Company, over whose tracks we operate, and who furnish power to our company. Tests are also made by experts representing our company.

Mr. Wason.—On one of our suburban lines we started two years ago to put on two 75-hp motors on each car, and found it almost impossible to make our time in the city, or in the country where there was any grade. We did that for the purpose of eliminating one-half of the repairs, as we supposed. Later, we removed the two 75-hp motors and put on four 50-hp motors, with much more satisfactory results, as we were able to make our time and consumed but a very small amount of power more than with the two 75-hp motors. The results were very much more satisfactory, and I think there is no question but for all suburban work four motors are preferable to two motors, no matter what the amount of power you put into the motors is.

The lightening up of a car for suburban work seems to me a little questionable. I think that a year from now Colonel Heft will be able to give us some more definite data on this point. We have been strengthening our cars from the start, rather than making them lighter. Sometimes now they leave the track for a shorter road across the fields. It seems to me that we ought not to consider making the cars lighter. The ordinary railroad man buys his equipment and expects it to last a reasonable length of time, and it seems to me that it must be strong. Of course, the strength should be put in the best possible places, and I think that, rather than making the car lighter, we should make it stronger. In the steam railroad practice the car is cambered up in the center. In the first of our suburban cars the manufacturers insisted upon putting the camber in the center, but we found after using the car a short time we could put the camber there ourselves. The trouble was to keep it from bulging up in the center, so that a truss rod in a long 40-ft. car was a useless thing.

Mr. Harrington.—I would ask Mr. Beggs what the tests showed where they ran two No. 57 motors, compared with four G. E. 1000 motors—whether the results from the four G. E. 1000 motors showed a less consumption in power than they had in the use of the two No. 57 motors?

Mr. Beggs.—The current was less on the four G. E. 1000 than on the two No. 57.

Mr. Harrington.—Did not you get better results?

Mr. Beggs.—We got quicker acceleration. I want to say here, as our experience, and to throw out a suggestion as opposed to what might be inferred from Mr. Foster's remarks, that whether the service is for 8 miles an hour, about the standard for city service—our city service is maintained pretty close to 9 miles an hour on the average—whether the service is for 8 miles, or 15 miles, or for 50 miles an hour, put four motors on a double-truck car. The distance does not make any difference whatever. The main question with many roads in this matter is the increased investment, but you will save the interest on the increased investment in reduced cost of maintenance. It costs considerably less to maintain four motors under a car of the same size than it does to maintain two motors under the same car. The difference in cost of maintenance will more than offset the interest on the increased cost of the investment.

Mr. Connette.—Mr. Beggs has just answered the question I was going to ask, whether or not the increase in the efficiency of the motors by reason of having four motors rather than two would compensate for the increase in the investment. I presumed that would be the case with four motors as compared with two motors. Mr. Beggs states that the maintenance is less. I wanted to know something about that point, and as that question has been answered, I do not think I have anything further to say.

President Roach.—Gentlemen, we have Mr. Vreeland of New York with us this morning. I would like to have him say something on this subject, or such other subject as he may wish to talk upon. We ought to have some benefit of his great knowledge of the business.

H. H. VREELAND.—We have gotten into rather a technical discussion. I do not claim to be a technical man. Our peculiar conditions in New York are such that we cannot go into the character of construction which warrants the use of the standard double-truck car with four motors. We do it on a number of lines controlled by the syndicate which owns the New York lines, and wherever it is possible, and we are not held down to the matter of a sixteenth of an inch in step heights, as we are in Greater New York, we go to the square-body car and use the four motors. The peculiarity of our streets in New York is such that longitudinal lines, by reason of Central Park, have to use very narrow streets. We have to conform to the old type of construction, with sunk panels, to keep the cars moving. We have a number of cross streets through which the important lines operate, and the difference between the sunk-panel car and the square-body car means keeping the line in operation all the time, as against stoppages every once in a while of from ten to twenty minutes, owing to the numerous teams using the streets during the day. Take, for instance, our Fifty-Ninth Street line, running across town. If an ordinary truck is standing at the curb, the hub will go under the sunk panel of our car; while if we used a square-body car, we should not be able to pass. We also find it necessary to have step-raisers.

I want to say, as I said not long ago on this proposition, and as has been expressed a number of times, we are not trying to do gilt-edge railroading in New York. I mean to say that these things are not necessary. I had a man recently say to me that he thought it was an unwise thing to have step-raisers of an open car under the control of the motorman. It means to us on the down town streets of New York that the motorman can signal the conductor to raise the step and pass a truck without a stoppage of the car, which, under the ordinary conditions of a solid step, could not be avoided, and when you are running the cars five seconds apart, as we do in Centre Street, down town, it is a great advantage to be able to raise the step and allow the car to pass.

The proposition under consideration is so local with us in that respect, that to discuss it from the standpoint from which these gentlemen have taken it up would not amount to much, except as concerns our experience with the consolidated system in New Jersey, where we run high-speed, long-distance interurban cars. On that system we use the large type of car with four motors. We get the largest carrying capacity car we can with the highest speeds, and do not consider particularly whether there is more or less power consumed, if we can compete successfully with the surrounding steam railroad conditions. We have long lines, and in every instance they are in competition with the steam railroads.

The Board of Railroad Commissioners of the State of New York recently made a very thorough test of brakes. While we had nothing to do with that test, our men put on the instruments, and in this way we got some figures as to the power taken with our single and double-truck cars. Both are equipped with two motors, and the test showed that with the same sized motors on single and double-truck cars, there was an increase of about 20 per cent in the consumption of current in the double-truck car. I speak of this because I am uncertain whether it was due to the increased weight of the car or the increased length of the car. So far as the question of general car construction is concerned, we have not to consider so much the question of collisions at high speeds as we have the question of a "hogging" of the cars, as we term it; and as Mr. Wason says, it is no trouble to get any kind of a camber in our Broadway cars.

MR. SERGEANT.—I have been extremely interested in the paper which Mr. Heft has presented. I want to say, in the first place, that I have seldom seen so much valuable matter so admirably put in so few words. I think this paper is a model of brevity and information. On the question of power, of four-motor cars versus two-motor cars, or two-motor cars versus one-motor cars, there seems to be considerable difference of opinion. While we have had no experience in actual service with four-motor cars, for the purpose of determining what the power consumption was, we made some very careful tests with two and four-motor equipments. We found with the ordinary railway motors of different types that we got a little better acceleration with the four motors. We obtained, as a matter of fact, 10 per cent decrease in time, better speed, but we had to use 50 per cent additional current to get it. I should suppose the question is one of local conditions. Certain electricians have been trying to persuade me for years that two motors consumed less power than one motor. We have records covering a good many years that one motor consumes less power than two motors..

In regard to our elevated equipment, possibly we have been making a mistake. What we are intending to use is motor cars having one motor truck with 150-hp motors on that truck, making a motor truck and one trailer truck. Every car will be a motor car, and we will use the multiple control system. I hope inside of the next year, if you come to Boston, we can show it to you in successful operation. It will be the only elevated road which will go underground as well as be elevated, and we have to overcome long grades of 5 per cent and descending grades of 8 per cent. We feel, therefore, we want the greatest acceleration we can get.

MR. MACCORMACK.—While I was with the Brooklyn Rapid Transit Company, the president of that company thought it was advisable to have double-truck cars, and the first car that was built had the wheels all of one size, and the question came up whether it was advisable to put four motors on the car or two motors. Tests were made to decide this question, and it was finally decided to equip the cars with two motors on account of maintenance. An order was placed for double-truck car bodies. We had not yet determined whether we had the right kind of truck, and whether it was advisable to use four or two motors. We had some maximum traction trucks on the road, and in making the test in regard to the power and the efficiency in acceleration, it was found that the maximum traction truck was giving much better service. In consequence, we adopted the maximum traction truck, and I believe it was the only truck we could work with two motors and continue the service in Brooklyn. The fifteen cars referred to were equipped with wheels which were all of one size, and we had to pull those cars off the road whenever we got 3 ins. or 4 ins. of snow on the ground. It was absolutely impossible to get them over the road. I complained to the president of the company, but he thought I was wedded to the maximum traction trucks, and insisted on running them. One day he happened to be at Richmond Hill, going to Brooklyn. It was a twenty-four-minute run from Richmond Hill to Ridgewood. The president got on one of the cars with wheels all the same size, and he was fifty-two minutes getting there. He thought the wheels traveled a thousand miles. These cars were equipped with two motors. The next day we discontinued the use of the fifteen cars equipped with these trucks, because we had so many delays. They dragged the road and it was found impossible to operate them.

In Cleveland, when I went with that company, I found that all the cars were double-truck cars with wheels the same size. Some time ago I had a cyclometer put on the

driving wheel, the wheels equipped with the motor, and a cyclometer on the idle wheel, and the record showed that the driving wheel made many more revolutions than the idle wheel. I do not know that I can say much more, Mr. President, for the information of the gentlemen, but I want to say, in reference to Mr. Heft's paper, that it will give us more food for thought and study than any other paper presented to this association. There is one important thing he speaks of, and that is doing away with the brake-beams, having the brakes hung and operated direct, without brake-beams. I think that is something that can be appreciated, particularly in view of the trouble we have had in regard to chattering brake-beams and brake-beams catching up rubbish on the road, and sometimes when we have accidents we will find that brake-beams are a large factor in them.

Mr. McCulloch, Chicago.—Colonel Heft's paper has been discussed almost entirely on the question of economy in power, and from the standpoint of the strength of the car in its construction to resist damage from collisions. Most of us who have been in the street railway business a good many years remember when our cars were only 10 ft. in length, and to-day we have them 46 ft. in length; then they weighed 4000 lbs., and now they weigh 40,000 lbs. Then we had only 1 hp, or 2 hp, and now we have 268 hp. We did not consider the question of power at all, nor the question of the strength of the car to withstand shocks. We were considering how we should be able to carry more passengers, and how we could better please the man who has the nickel. I do not think it is a question at all of whether we shall use a little more horse-power or not if we can carry in greater safety the passengers who are in our cars, and we can carry a larger number of passengers. We can very well afford to burn an additional bushel of coal if we can carry a few more passengers to pay for it.

As to the collisions which have been referred to, and the construction of the cars to withstand the shocks, I suppose the only way to prevent collisions is to run the road with only one car. When we have a collision we do not consider what has become of the car, whether its transverse section is weak, or how much it will cost to repair it. What we do is to institute inquiries to find out whether there was some woman in the car whose transverse section was weak, and we shall have to pay for it. (Laughter.)

President Roach.—Gentlemen, you have heard the paper read and the full discussion which has been had upon it. What is your further pleasure in regard to the paper?

Mr. McCulloch.—I move that the paper be received and placed on file, with the thanks of the association to Colonel Heft for having written it.

The secretary announced that the members of the association were cordially invited to visit the plant and park of the East Side Electric Railway Company. An invitation was also read from the Country Club, of Kansas City, Mo., extending the privileges of the club to the members of the association. A further invitation from the American Stoker Company was read, inviting the members to visit a power plant equipped by that company.

President Roach.—Gentlemen, the next order before the convention is the report of the committee on nominations. This committee will also include in its report a recommendation as to the next place of meeting.

Mr. McCulloch.—With the consent of Mr. Rigg, the chairman of the committee on nominations, I would like to make a statement. In suggesting those who shall be our officers for the coming year, some member of our nominating committee has guaranteed strict attention to the duties of the office by each one of those we recommend, and we will ask any of the gentlemen who are nominated if he does not mean to attend to the duties of his office, if he is elected thereto, and give his earnest support in helping to carry the association along in a successful way, and give his personal attention to the meetings of the committee, we would like to have him decline the election, and let someone else be put in his place who will attend to the duties of the office.

Mr. Rigg, chairman of the committee on nominations, presented the following report:

Kansas City, Mo., Oct. 18, 1900.

To the President and Members of the American Street Railway Association:

Gentlemen—Your committee on nominations respectfully reports that it recommends New York City, N. Y., as its next place of meeting, and also recommends the following gentlemen for officers of the association for the ensuing year:

For president, Walton H. Holmes, president Metropolitan Street Railway Company, Kansas City, Mo.

For vice-president, Herbert H. Vreeland, president Metropolitan Street Railway Company, New York, N. Y.

For second vice-president, N. H. Heft, president Meriden Electric Railroad Company, Meriden, Conn.

For third vice-president, J. B. McClary, general manager Birmingham Street Railway Company, Birmingham, Ala.

For secretary and treasurer, T. C. Penington, treasurer Chicago City Railway Company, Chicago, Ill.

Executive committee, the president, vice-presidents and John M. Roach, Chicago; F. L. Fuller, Wilkesbarre, Pa.; George W. Baumhoff, St. Louis, Mo.; John R. Graham, Quincy, Mass., and John Harris, Cincinnati, Ohio.

The following resolution was unanimously passed by the committee:

Resolved, That the next meeting of the American Street Railway Association be limited to three days instead of four, and that the day set apart for the personal examination, by members, of the supply men's exhibit be the middle day of the interval. Very respectfully submitted,

John A. Rigg, Chairman.
Robert McCulloch.
E. G. Connette.
E. C. Foster.
D. B. Dyer.

President Roach.—Gentlemen: The election of officers is by ballot, and I will select Mr. McCulloch, of Chicago, and Mr. Beggs, of Milwaukee, to act as tellers.

Mr. Bean, St. Joseph.—I move that the secretary be authorized to pass the unanimous ballot of the meeting for the gentlemen nominated. Carried.

The secretary duly passed the ballot and the president declared the gentlemen nominated to be duly elected as officers of the association for the ensuing year.

President Roach.—There will be no further meeting of the association, but we will adjourn until to-morrow night at 7 o'clock, to meet at the Coates House for the annual dinner.

I desire to thank the members of this association for their kind consideration while I have been your president, and if there is anything I can do at any time to help the association, I will be pleased to have you call upon me while here and at home. (Applause.)

I will state, in reference to the paper which was to have been presented by Nicholas S. Hill, Jr., general manager of the Charleston Gas & Electric Company of Charleston, S. C., on "The Storeroom and Storeroom Accounts," that Mr. Hill has been ill for a long time, and has been unable to prepare the paper.

MR. HEFT.—I move that the thanks of the members of this association be tendered to our able and genial president and the other officers of the association, for the able manner in which they have conducted the affairs of the association during the past year.

The motion was carried by a rising vote.

MR. VREELAND.—Before we adjourn, it would seem right along this line that it would be proper for this association to express its appreciation of the entertainment that has been extended to the members of this association by the Metropolitan Street Railway Company of Kansas City, and by the leading citizens of Kansas City, whose generosity has never been paralleled in my history in connection with associations of this character.

The motion was put and unanimously carried.

The meeting then adjourned.

The Entertainments

The entertainments provided for the attendants at the convention were worthy of the traditions of the Street Railway Association, and were heartily enjoyed. To those who had never visited the city before, and they comprised a large portion of those in attendance, the excursions to the neighboring points of interest were particularly welcome.

The first regular entertainment was a beautiful reception given in the parlors of the Midland Hotel on Tuesday evening by the officials and the Kansas City committee and their wives to the visitors. The full suite of parlors on the first floor and the grand stairway were utilized for this purpose, and were decorated by a profusion of palms and other potted plants, while over the hall mantel and at various other places were great bunches of American Beauties, with sheaves of carnations on the center tables. An orchestra, screened behind palms under the stairway landing, furnished music, and refreshments of punch, sandwiches and cakes were served from small tables. Many Kansas City people were invited to be present, and they and the visitors were well cared for by the reception committee, made up as follows: Mrs. C. F. Holmes, chairman; Mrs. G. T. Stockham, Mrs. Chester Snider, Mrs. J. H. Durkee, Mrs. W. E. Kirkpatrick, Mrs. W. A. Satterlee, Mrs. Walton H. Holmes, Mrs. A. M. Crow, C. F. Holmes, G. T. Stockham, John Brown, F. J. Taggert, Col. C. F. Morse, W. T. Osborn, Lathrop Karnes, Frank Peck, Henry Evans. Besides the ones named, the Commercial Club sent over a delegation headed by H. W. Evans and Secretary E. M. Clendenning. Most of the delegates to the two conventions were present.

During the afternoon many delegates spent their time at the Convention Hall inspecting the exhibits. Others improved the opportunity to drive about the city or take trips through the residential portions or into the suburbs on the cars of the Metropolitan Street Railway Company. As usual, the buttons of the association provided free transportation on all the lines in the city and vicinity.

On Wednesday evening a large party visited Armour's packing house, the largest establishment of its kind in the world. Fifteen special cars assembled about 2 o'clock at the corner of Eighth Street and Grand Avenue, close to the Midland Hotel, to transfer the visitors to the Armour establishment. Most of the attendants, including a large number of ladies, participated in the excursion, and as many of them had never seen a packing house before, the sights they beheld were found of much interest.

In the evening, the attendants were entertained at Coates Theater, the entire house of which was placed at their disposal by the Metropolitan Street Railway Company. Tickets were distributed by the secretary, and the theater was crowded. The performance was "The Runaway Girl," and several local hits were made which amused the audience greatly. At one point in the performance a reference was made to the convention button, and as the heroine, Miss Jerome, complained that no button had been provided for her, a large tin button the size of a dinner plate and corresponding to that worn by the delegates was handed over the footlights amid the laughter of the audience.

While the delegates were at the convention hall in the morning, the visiting ladies were taken for a drive about the city in coaches. Parties were made up at the Baltimore and the Coates and taken to the Midland, the general headquarters, whence the entire party started. The regular ladies' reception committee, Mrs. C. F. Holmes, chairman, had the party in charge, and three tally-hos were filled with sightseers. They were taken through Grand Avenue, East Eleventh, Locust and East Ninth Streets, the Paseo, Gladstone and Independence Boulevards, to Scarritt Point, back to Fifteenth Street, out Troost Avenue and Warwick Boulevard, through Westport and to the Country Club, where luncheon was served. From thence the party returned to the Midland, where all joined the crowd that went to Armour's.

On Thursday afternoon a very interesting trip was made to Fort Leavenworth, and the National Soldiers' Home at Leavenworth. A start was made by special train over the Missouri Pacific Railroad from the Union Depot, about 2 o'clock, and the fort was soon reached. This is an historic structure established in 1827, at the time when it was needed to protect the early settlers against the Indians. While the conditions have changed entirely since that time, it is still maintained as a large post, and is one of the most important home military stations in the country. Within the grounds are also the United States penitentiary, also a new Federal prison, now being built by convict labor. The visitors were met on their arrival by Government officials and escorted through all the buildings, after which a return was made to the train, which proceeded to the Soldiers' Home. This is also a Government institution, some 8 miles from Fort Leavenworth. A fine lunch awaited the visitors, after which they were escorted about the grounds by resident officials, and entertained by a fine band concert. The return was made to the hotels in Kansas City about 7.30. Some of the visitors made the trip to Kansas City by the trolley line of the Kansas City & Leavenworth Electric Railway, others by the train, while quite a considerable part went to Fort Leavenworth by trolley.

During all of the three days a great many of the visitors improved the opportunity by making trips about Kansas City on the cable and electric cars. For this puprpose Mr. Holmes generously placed at the disposal of the delegates his own private car, and those who had the fortune to ride upon it greatly appreciated this act of courtesy. The grounds of the Country Club, as well as its golf links, were thrown open to the delegates, many of whom improved the opportunity of visiting these beautiful grounds.

As mentioned in the proceedings, the Kansas City Club and the Elks' Club also extended the entrée to their rooms to the visitors. Here also the official button was all that was required to gain entrance. This courtesy was very greatly appreciated, and many took advantage of the kind invitations, especially in the case of the Kansas City Club, whose fine clubhouse was located near the Convention Hall, and was thus very accessible.

On Friday afternoon the vaudeville entertainment provided to the delegates by the supply men took place in the

convention hall. It was preceded by a parade starting from the convention hall and passing through the downtown districts. The cavalcade, which followed a band, was led by a remarkable looking animal to which it would have puzzled a professor of natural history to have given a correct name.

The vaudeville show in itself was a great success, and the fact that so much talent existed off the stage was a surprise to many. In the evening occurred the banquet, which is described elsewhere.

The Banquet

The banquet at the Coates House Friday evening was the formal ending of the convention. It was unfortunate that the calls of duty were too importunate for some of the delegates to enjoy the sumptuous repast provided, but there were some 200 who remained and partook of the choice viands and rare wines with which the board was spread. The banquet was served in the grand dining-room, the decorations of palms, ferns and great bunches of American beauty roses being most elaborate. At a long table across the east end, presided over by Vice-President John A. Rigg, toastmaster of the occasion, sat the officers and executive committeemen and the speakers of the evening. There were several substitutes among the latter, and the members of the entertainment and banquet committee are to be congratulated on the ability they displayed in obtaining such excellent alternates to those speakers who were prevented from attending. Even the president, John M. Roach, had received an important summons and had left for home earlier in the day, necessitating a change of toastmaster. Vice-President Rigg, however, proved himself most efficient in this capacity, and about 11 o'clock, as he mounted the platform of a car front which formed part of the decorations, he was greeted with hearty applause by the diners. This car front was a unique representation of a Metropolitan car platform, complete with brake, controller, gong, etc. Mr. Rigg in a few well-chosen words of compliment introduced President-elect Holmes as motorman and incidentally the toastmaster of the occasion. Thus was the new president most gracefully installed, and the banquet proceeded with added gaiety.

After a short address the new toastmaster introduced W. S. Gilbert, who responded to the toast, "Looking Backward," and brought out much laughter and applause by his witty treatment of the history of railroading. Frank Hagerman was down upon the programme for the toast, "The Trial Lawyer," but his place was ably filled by Judge McAnany, who divided his remarks into four stories illustrating four stages in the life of the average legal aspirant. J. H. Stedman, of Rochester, responded to "Our Guests" in place of Gardiner Lathrop, but he really took advantage of the opportunity to thank the city for its entertainment. Other toasts were most humorously handled by Frank B. Walsh and Chester Snider, and the merry-making lasted far into the night.

It was evident to all the delegates and their friends that the hospitality of Kansas City includes music which deserves the name, and the orchestra, which kept in almost constant tune during the banquet, was greatly appreciated. The only lulls were occupied by songs by the Virginia quintette and others. The *menu* was most artistic, and the appropriate design of a Metropolitan trolley car with some amusing side-lights created many a laugh. Altogether the banquet was a most fitting climax to a most successful convention, and will leave a pleasant memory with all the fortunate ones who attended.

Walton H. Holmes

Walton R. Holmes, the new president of the American Street Railway Association, comes of a family which has long been directly associated with street railway properties. In 1871 the first street railway to be opened in Kansas City was started by Nehemiah Holmes, father of the new president. This road consisted of a horse car line between Kansas City and Westport, and in 1875 Walton Holmes, then only about twelve years old, entered the service of the company in a subordinate position. He has therefore been intimately connected with all the important developments which have taken place in the growth of what is at present one of the largest and best operated systems in the West.

Before he was twenty-one Mr. Holmes was made vice-president of the road, and since that time, in connection with his brother, Conway F. Holmes, who has also remained constantly prominent in the affairs of the company, he has been identified with the management of the property

WALTON H. HOLMES

and largely responsible for its remarkable success. He is a man who does not believe in being "penny wise," but has the faculty of making business come to him by the judicious expenditure of money in building new lines. This liberal policy of opening up undeveloped territory upon the outskirts of the city, supporting in every way the improvement of the public parks, and giving the people what they want before they have learned to ask for it, has reflected upon the company the benefits merited and has placed Mr. Holmes, personally, among the leading citizens of the town. His long familiarity with every detail of the operation, his love of the work and his ever ready help to his employees, make him extremely popular with the men, and it is not an uncommon sight when accidents or breakdowns occur, as they will even in Kansas City, to see him directing operations or occasionally lending a hand, with a knowledge of detail and a hearty good-will that only long years of experience can give.

The present Metropolitan Company, of which Mr. Holmes is now the president, was organized in 1886. With its organization may be said to have begun the modern trolley régime in the city. The company now has about 160 miles of road, of which 120 miles are electrical and 40 miles cable. The transformation of many of the cable lines to electric is a matter of but a few months, however, as they have already been condemned by the management and the work of installing a trolley system begun.

Mr. Holmes is not only public-spirited in theory, but is largely interested in many important enterprises. He is president of the Kansas City Electric Company and has given his financial support to many other public service properties. His well known services on the executive and local committees guarantee the efficient fulfilment of his presidential duties, and the convention of 1901 is assured of an energetic, painstaking and satisfactory chairman.

Echoes of the Convention

President Roach made an excellent presiding officer, and was one of the most conspicuous figures of the convention.

C. S. Palmer, president of the Bar Association of Kansas City, and attorney for the Heim Line, was a regular attendant at the convention.

The display of blanks and forms made by the Accountants' Association attracted widespread comment and interest among members of both associations.

Many favorable comments were made upon our October issue, and we wish to take this occasion to thank the many who extended us their congratulations upon it.

T. M. Jenkins, general manager of the St. Louis & Suburban Railway Company, showed his great interest in the convention by bringing to it a large number of his staff.

John A. Rigg, of Reading, of whom one of the Kansas City papers said that he was president of 110 electric railways, was present and took an active part in the convention.

The daily published on the four days at the convention by our contemporary, the *Street Railway Review,* was eagerly sought after, and was highly creditable to the publishers.

H. H. Littell, who was president of the first convention, held in Boston in 1882, was present at Kansas City and had a host of friends. He was accompanied by his son, Clarence Littell.

Hon. E. P. Shaw, of Boston, was a prominent attendant at the convention. Mr. Shaw has been State treasurer of Massachusettts for a number of terms, and is very influential in electric railway circles in Boston.

W. Worth Bean was present during the final days of the convention, and was one of the very few there who had never missed a convention. Mr. Bean was absent during the opening of the convention owing to sickness in his family.

The visiting ladies were well entertained during the four days of the convention. The excursions and plans for them included several trips about the city, a visit to the Country Club in tally-hos, and a special luncheon on Friday afternoon tendered by Mrs. C. F. Holmes.

Cleveland was well represented by Ira A. McCormack and C. W. Wason. Both these gentlemen have the highest reputation as street railway managers, and have done much to advance the interests of the properties with which they are connected, as well as of the association.

Many delegates participated in the special trip over the Heim Line, tendered by the managers of that company to the association on Friday morning. On the same morning the accountants were the guests of the Metropolitan Company on a tally-ho drive. They were shown about the city by J. A. Harder, auditor of the system, who was elected vice-president of the Accountants' Association.

The vaudeville show given at the convention hall on the afternoon of Friday was well attended and well presented. All of those who were instrumental in thinking of and arranging for this entertainment are deserving of thanks, but especial mention should be made of Elmer P. Morris and V. C. Gilpin, who devoted a great deal of time to the undertaking.

Telegraph, postal and express offices were opened in the convention hall, and proved a great convenience to the delegates and exhibitors. The different departments at the convention, including the registering department, were in charge of conductors of the lines of the Metropolitan Street Railway Company, and their tasteful blue uniforms and attractive appearance spoke ably for the high class of men employed on the system.

One of the pleasantest features of the convention is that of meeting old friends. The street railway consolidations of the past few years have made many changes in personnel. In many cases old-time friends have been separated and have taken up their residences in cities thousands of miles apart. A street railway convention enables them to come together often for the only time during the year, and this occasion was enjoyed fully.

The address of John I. Beggs, of Milwaukee, before the Accountants' Association, on "What Does the General Manager Want to Know of the Accounting Department?" was generally considered as one of the clearest and most concise summaries ever made outlining the work of any one department in street railway operation. Mr. Beggs is a forceful speaker, and his long experience in electrical work makes his opinions on any subject related to electrical traction or lighting of great value.

The proposal of the supply men to relieve the local managers, in future conventions, of the details connected with placing of exhibits, etc., through the action of a standing committee, seemed to meet with general favor. This is always an arduous task, and it hardly seems fair to impose this work on an official of the street railway company where the convention is to be held. In this connection it might be said that this work was most admirably carried out at the Kansas City convention, and reflected great credit on the Kansas City authorities.

Many familiar faces were absent from this convention; among them were Charles Clemenshaw, of Troy; C. T. Yerkes, of Chicago; E. S. Goodrich, of Hartford; H. C. Moore, of Trenton; John W. McNamara, of Albany; D. G. Hamilton, of Chicago; C. D. Wyman, now of Boston, and formerly of New Orleans; A. E. Lang and Thomas H. McLean, of Toledo; W. F. Kelley, of Oakland; E. E. Higgins, of the STREET RAILWAY JOURNAL, and John A. Brill, of Philadelphia. Others whom all would have been glad to see were John B. Parsons, of Philadelphia, and F. A. Fuller, formerly of Chicago, but now of Wilkesbarre, and who was elected to membership in the new executive committee.

The Brooklyn Heights Railroad Company was well represented at the convention by Clinton L. Rossiter, president; Eugene Chamberlain, superintendent of equipment; William Robbins, division superintendent, and Newton W. Bolen, division superintendent. Mr. Rossiter took an active interest in all the proceedings and also made a most careful investigation of the exhibits. Mr. Chamberlain is a newcomer in the street railway field, and made many friends on the special train and at the convention. He was formerly connected with the New York Central & Hudson River Railroad Company, and is one of the many steam railroad men who have been selected to control the affairs of important street railway systems.

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Special effort will be made to answer promptly, and without charge, any reasonable request for information which may be received from our readers and advertisers, answers being given through the columns of the Journal *when of general interest, otherwise by letter.*

Street railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our news columns.

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The Kansas City convention terminated with the banquet at the Coates House, Oct. 19, and the American Street Railway Association closed the nineteenth year of its history. It is extremely gratifying to both the officers and members of the association that, with the additions to its membership announced at the Kansas City convention, the association is now larger than at any time during the past eight years. This is all the more striking because the withdrawals have not signified a lack of interest in the aims and purposes of the association, but, as stated by the secretary, are due in nearly every case to consolidations. Thus many of the large cities of the country, like New York, St. Louis, Kansas City, etc., which sent to former conventions eight or ten delegates from many member companies, were represented at the convention which has just passed by one or at most two companies, which control all the lines in their respective cities.

No better commentary can be afforded of the extension and growth of the electric railway industry than the fact that the large number of interurban railways, which are now pushing their way through all sections of the country as rivals of the existing steam railroad lines, more than make up in numbers the loss occasioned by the existing tendency to unite under one management the local lines in each of our large cities. It is also significant that these large interurban properties, many of which correspond closely in operating conditions to the steam railroad lines to which they are contiguous, ally themselves naturally with a street railway association rather than one composed of steam railroads only. There is more reason for this than the use of the same motive power. That alone would not be a bar to uniting with the steam roads, as it is well known that they also are making a careful study of electricity as a motive power for their branch lines. The real reason lies in the fact that the modern city street railway system is no longer merely a tramway. It installs the heaviest track, employs nearly as long cars and runs them at speeds approaching those used in the open country. Its conditions, therefore, approximate more and more closely those on interurban roads proper, and the problems presented on each are growing more continually alike. Even the steam railroad companies themselves, which have gone into electric traction, like the New York, New Haven & Hartford Railroad Company, find, when investigating electric problems, that the American Street Railway Association is the medium through which experience in this line can best be obtained. The conclusion inevitably reached by this tendency is that the broad questions of electric traction, in all its phases, will ultimately have to be solved by the American Street Railway Association, as the one best fitted to deal with the situation. That it is capable of doing this no one acquainted with it will for a moment doubt. It will and must take in all branches of electric railroading, and, living up to its best traditions, be the exponent of the wider field of electric traction, as it has been in the past of city transportation.

* * *

Although Kansas City is further west than any city selected for a street railway convention in the past, the attendance was large and the exhibits were as interesting, taken as a whole, as at any previous convention. The long ride West undoubtedly did deter certain members who live in the East from attending the convention, and a number of cities, particularly in New England and the Eastern Middle States, which have previously sent delegates, were not represented at the convention. This deficiency was nearly made up, however, by a larger attendance from the cities in the Middle West. It was the general hope that more managers from the Pacific Coast would be able to attend than at previous conventions, but this was not the case. While this was a disappointment, it must be remembered that Kansas City is as far in distance, and further, reckoned by time, from San Francisco than from New York, and while a few companies in California sent delegates, the three States bordering on the Pacific Coast, with their important street railway systems, were for the most part unrepresented. The striking feature of the convention, however, was not those companies who were not present, but those who were, and the fact that cities as far distant as Portland, Maine; Boston; Augusta, Ga.; Atlanta, Ga., and Birmingham, Ala.,

not to mention many others, sent three or four delegates each to attend a four days' convention, is sufficient proof that there is no lack of enthusiasm and desire for improvement in the managers who control the operation of our vast street railway systems.

* * *

The weather was ideal and the association was royally entertained by its host, the Metropolitan Street Railway Company, of Kansas City. Too much credit cannot be given to the local committees who had the arrangements for the convention in charge, but especial mention should be made of the entertainment committee. Its members were indefatigable in caring for the welfare and pleasure of the attendants at the convention and providing entertainment for them, and also for the ladies, while the others were in attendance during the morning at the convention hall. Many favorable comments were also passed on the system of the Metropolitan Street Railway Company, which was inspected for the first time by many of the railway managers present. The local conditions of the city have compelled the continuance there to a large extent of the cable roads, but both cable and electric lines were found maintained in an excellent condition, the track work and rolling stock compared favorably with those elsewhere, and the principal electric power station of the company, as is well known, is one of the most economical of any railway system. The grades surmounted by the electric as well as the cable cars, the attractive appearance of the cars, the high grade of employees and the efficiency of the service, all called for high encomiums, and words of praise were unstinted as to the character and equipment of the lines in Kansas City.

* * *

The exhibits equaled in interest, if they did not exceed, those of past conventions. The electric railway business is such a recent development that a railway manager, to secure the greatest efficiency from his service, must keep posted on the improvements in apparatus made from year to year, and there is no better or quicker way of doing this than by a careful inspection of the new apparatus shown at the annual conventions of the American Street Railway Association. In fact, these exhibits are now generally regarded as one of the most important instructive features of the convention, and receive careful attention. One prominent Eastern manager remarked to us that he made it a point to visit every exhibit at every street railway convention which he attended, and that he had never left a convention without placing at least one important order as a result of the examinations he had made of the apparatus shown. No sample cars were exhibited either inside or outside at the convention hall, and in this respect the exhibit differed from any which has been held for a long time. Another feature of difference was in the fact that the exhibits all meant something. There was a notable absence of a tendency to show simply piles and pyramids of the different appliances exposed, but the samples presented had each a bearing on its desirability in railway operation.

* * *

It was a source of regret to many that more results were not accomplished in the actual proceedings. Of the five papers on the programme four only were presented, and of these two only were read by the authors. This was extremely unfortunate, as to secure the best results the author of a paper should be present to answer questions which may be raised by the presentation of his paper and to elucidate any points mentioned in it which may not be perfectly plain to the members. It was also extremely unfortunate that there was practically no discussion on any of the papers except one. We noticed in one of the Kansas City papers that the statement was made that the meetings of the association were held principally for social intercourse. The editors thought that in saying this they were commending the convention and saying what would please the members most. The principal value of any large meeting of this kind, however, lies in the interchange of experience. While this applies to the meetings of every trade or scientific body, it is particularly true of a business like that of electric railroading, where such a large part of the work is experimental, and in which the best methods of caring for different problems have not yet been determined. For this reason, as we stated recently in discussing the proceedings of the New York State Street Railway Association, every means which will stimulate the discussion of the several points brought out in the different papers should be used to increase and add to the general knowledge on those subjects. At the same time, it is not always possible to depend upon entirely extemporaneous discussion of a paper from members who have simply heard it read. It would certainly seem as if the experience of other bodies on this subject would be of value. While there are some differences in procedure, nearly every other large body holding annual conventions prints its papers in advance and distributes them to the members. Then if they are long they are read by abstract only. Again, arrangements are made beforehand to have certain members commence the discussion, give their own methods on the subject treated, and approve or criticise the methods suggested in the paper. This plan, as stated in these columns recently, not only tends to produce the end sought in bringing out a full discussion, but in the case of a long paper will often economize considerable time. As a result, an association like the American Society of Mechanical Engineers will often have presented to it during a four days' session from twenty to thirty papers instead of four, as in Kansas City. With the International Tramway Association the practice is not only to print the papers before the meeting for distribution among the members, but also to publish a full appendix with each paper, giving in detail the opinions and practice of the other members of the association on the subject under discussion. This, of course, widens considerably the opportunity of debate.

* * *

The meetings of the association should also commence promptly. The Accountants' Association at Kansas City was notably better in this respect, as it was in the discussions, than was the American Street Railway Association. We should be glad, too, to see a renewal of the early practice of incorporating in the report of the executive committee a resumé of the progress made in the street railway industry during the past year and such pertinent reference to present problems as might be of assistance to the members. These reports used formerly to be of great value, and we believe that they would be helpful in pointing out lines of investigation in which the member companies could devote their energies to the benefit of themselves individually and of the association as a body.

Cincinnati extended, through its mayor and also through Mr. Kilgour, president of the Cincinnati Street Railway Company, a most cordial invitation to visit that city in 1901. New York, however, seemed to be the popular choice of the delegates, who evidently believed that the association should come East next year. This puts Cincinnati in line, however, for the convention in 1902. There are many who would be very glad to see the convention go there in that year, and the city, as well as the Cincinnati Street Railway Company, received well deserved recognition by the election of John Harris as a member of the executive committee.

* * *

The decision to hold the convention in New York next year met the unanimous and enthusiastic approbation of the delegates to the convention. The invitation, which was extended in the name of all the companies in New York and Brooklyn, was most cordially appreciated, and there was no dissenting voice to the decision as announced. New York will have much to show the members of the association during their visit to that city in 1901. In addition to the gigantic power station at Ninety-Sixth Street, which is now practically completed and then will be entirely so, the delegates will probably be able to see electric trains on the Manhattan Elevated Railroad. The power station of this company will probably not be entirely finished by next October, but the work ought to be so far advanced that an excellent idea can be obtained of the immense 11,000-hp units which will be used. New York City, of course, contains the best possible facilities for hotel accommodation and exhibition room in its magnificent hostelries and in the Madison Square Garden. Just what arrangement will be made for hotel headquarters and exhibit space, of course, will not be known until the ground is gone over carefully by the committee and the merits of all possible plans are considered. It is needless to say, however, that the association will be well cared for in New York, and it could not be in better hands than in those of Messrs. Vreeland, Rossiter, Maher and Beetem.

* * *

The proposition to limit the meetings of the convention to three days instead of four also met with hearty commendation. We believe this a wise step, as three days should be ample for the business of the association. It is proposed to make the time for the inspection of exhibits the middle day of the three instead of the last day of the four. This plan also seems a wise one. It is important, however, that the exhibits should all be ready for inspection by the morning of the first day, and exhibitors should be more prompt in this respect than at the convention just held. There, the proceedings of the association were disturbed to a considerable extent on Tuesday morning by the noise occasioned in putting on some of the finishing touches to the belated exhibits.

* * *

While the meeting hall of the association was not all that could be desired, we understand that the local committee was not responsible for its defects. It would have been possible, of course, to have secured much more comfortable and commodious quarters elsewhere outside of the convention hall, but the advantage of having the meetings held in the same building with the exhibits was too well recognized to have sanctioned any change from past customs in this respect.

No more popular selection for a president for the association was ever made than that of Walton H. Holmes, who, with his brother, Conway, gained the immediate favor of all the attendants at the convention by his good fellowship and assiduous devotion to the comfort of all.

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Mr. Holmes will be associated in his work in the association next year by a particularly strong executive committee. The first vice-president, Mr. Vreeland, is generally recognized as one of the leading street railway managers of the country, being conversant alike with the mechanical and financial conditions surrounding street railway properties, and possessing in a very marked degree the high respect and enthusiastic loyalty of his employees. Mr. Vreeland has taken a great interest in the welfare of the American Street Railway Association since his connection with street railroading, and was one of the vice-presidents of the association during the past year. Colonel Heft, of Meriden, who was elected to the office of second vice-president, is at the same time president of several city systems and the chief of the electrical department of one of our largest steam railroad corporations. To him more than to anyone else is due the credit for the successful development of the third rail for interurban lines, and his papers before several conventions have been marked by great thought and originality, and have been of much value to the street railway fraternity. Mr. McClary, the new third vice-president of the association, is an excellent representative of the Southern street railway manager. His system, which includes both city and interurban lines, is one of the largest in the South, and he has always taken a great interest in the association and in attending its meetings. The association was fortunate also in retaining the services on the executive committee of ex-President Roach, of Chicago. Mr. Roach has been most loyal to the association during the term of his office as president, and although an extremely busy man, has given his time freely to advancing the interests of that body. The other members of the executive committee, Messrs. Fuller, of Wilkesbarre and formerly of Chicago; Baumhoff, of St. Louis; Graham, of Quincy, Mass., and Harris, of Cincinnati, are all very well known, and no better selections could have been made. The excellent financial showing of Secretary and Treasurer Penington is a high testimonial to the care with which he managed the business end of the association. Mr. Penington added to his already great popularity by the uniform courtesy with which he treated all in attendance at the convention, and his re-election met with hearty approval.

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Many favorable comments were passed upon the work and enthusiasm of the Accountants' Association. Under the able presidency of Mr. Duffy, the association has done a great deal of valuable work. The meetings were well attended, the papers were able and well received, and the discussions were pointed. The department of blanks and forms, which is under the personal charge of Secretary Brockway, made a most interesting display. These forms were shown in sixteen blank books, which were shown for exhibition on a long table 96 ft. in length, located in the gallery between the meeting halls of the two associations. An interesting addition to the collection of forms made during the year was a complete set of blanks used by the Glasgow Tramways, of Glasgow, Scotland. As these differed in so many particulars from those used on our American roads, it was considered advisable to place them in a

separate book rather than to try to classify them with the American forms. The collection was inspected not only by the accountants, but by most of the delegates of the American Street Railway convention. In this connection it is interesting to note that the Accountants' Association includes in its membership a number of foreign tramway companies.

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The first paper read at the convention, by D. B. Holmes, on "The Consolidation of the Street Railways and Its Effect Upon the Public," was an able treatise on one of the most marked recent developments in railway organization methods. It is a popular doctrine in some quarters now to decry monopolies of every kind, and particularly street railway monopolies, but Mr. Holmes showed that all monopolies are not undesirable and that a street railway consolidation brings benefits to the public which could not be conferred by a number of independent systems operating in the same city.

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Mr. Bancroft's paper on "A Comparison of the Various Systems of Electrical Distribution for Street Railways" outlined clearly the six methods at present in more or less general use for this purpose, viz., the 500-volt continuous current system, the alternating-direct current system, the booster system, the three-wire system, the purely alternating system, the storage battery system; and the advantages and the disadvantages of each were outlined. The subject is an important one in electric railroading, particularly when the problem of power distribution for interurban traffic is considered, because these lines are, so to speak, on the border line, certainly so far as alternating power distribution is concerned. We should have been glad if Mr. Bancroft had discussed several concrete examples, citing some installation and operating costs for each of the two or three methods most applicable for the case under consideration. Again, if he had enlarged upon some of the problems which have arisen in the practical operation of the newer systems of power distribution, and described the methods by which these troubles have been overcome, it would have been of great value. This would undoubtedly, however, have increased the scope of the paper beyond that which was originally intended by the executive committee, but might well be taken up in a second paper next year.

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The subject of repainting and maintenance of street car bodies was treated in a paper by Mr. Brydges, superintendent of car shops of the Chicago Traction Company. It was a thorough, practical description of the methods employed by his company, which has given a great deal of thought to the subject, and as such was of great value to the other members of the association. Our only suggestion on the paper is that if figures could have been given as to the cost of the different operations described, it would have afforded a measure of comparison for the other delegates present. The paper brought out clearly the advantage of simplicity in lettering and ornamentation, not only as regards first cost, but especially maintenance. This, it is generally recognized, is most important. Not only the design of the lettering and the ornamentation, but the colors as well should be selected so as to insure the longest life and involve the least expense in maintenance and repairs.

The paper by Col. Heft on "Double-Truck Cars: How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions," contained the description of an entirely new type of car as well as of a very novel truck. While some doubt was expressed by the delegates present as to the rigidity and transverse strength of a car supported at the center, too much praise cannot be given to the author for the pioneer work which his company is doing under his direction in the development of a lighter car than is now being generally employed. Pioneer work is always expensive work, in the benefits of which, however, all the members of an industry participate; and whether the construction as described by Col. Heft shall be entirely successful, or whether experience with it will dictate certain modifications, the company with which he is connected certainly deserves the thanks of all those engaged in electric railway operations. The discussion which followed the reading of this paper was more upon the question of employing two motors or four motors on a double-truck car than upon the actual construction of the car described by Col. Heft. This is a very important subject, and our discussion on it will be found below.

Four-Motor Car Equipments

There seems to be no question from the practical standpoint that four-motor car equipments have come into the art to stay, and that they form a very useful means for accomplishing certain satisfactory results. A four-motor car equipment means that every axle on the car is a driving axle, and that all of the weight of the car is directly available for traction. This implies a better grip on the track than can be secured where only part of the total weight is available for traction. The development of the motor-car equipment in this line is strictly in accordance with modern railway practice, which puts, where traction conditions are heavy—as in grade climbing over the mountains—as much weight as is possible on the drivers of the locomotive. Where the service conditions in electric railroading are such that quick acceleration is a matter of fundamental importance, the four-motor car equipments have a most material practical advantage. The equipment, however, is more costly for the same output, and somewhat more complicated than the more common two-motor car equipment, and the general consensus of opinion among the practical street railway managers who have carefully considered the question seems to be that for the same service the four-motor equipments require about 15 per cent to 25 per cent more energy than the corresponding two-motor equipments. Supposing, in each case, that the motors are of similarly good design, the causes of this difference in power required forms an interesting subject of study. An increase of 20 per cent to 25 per cent in power demanded means a very material loss of efficiency at some point, a loss which assuredly must be located to obtain a proper comprehension of the results. Now, it has long been known among steam railway experts that the wear of the track depends more on the engines than on the cars for equal weights in the respective cases. Likewise it has appeared in numerous experiments with electric trains composed both of motor cars and trailers that the power per ton required to drive a motor car, after making the fullest allowance for the loss of efficiency in the motors and gears, is very considerably greater than the power required

per ton to pull a trail car. The experiments, being made under widely differing conditions, have not been very concordant as to the exact amount of this increase in power, but as nearly as can be ascertained it may range from 25 per cent to even as high as 50 per cent.

We think the key to the situation will be found in this difference between the track friction of the driving wheel and the rolling wheel of the trailer. There is every reason to expect, in case of a driving wheel—particularly when working during rapid acceleration very near to its limit of adhesion—a grinding friction on the rail, which is quite distinct from the rolling friction of the wheels on the trailer, or the wheels not driven on the motor car, and very considerably greater in amount. In other words, there may be material slipping of the driving wheel, and even when the slipping does not rise to any considerable amount, there is a tendency to grind wheel and rail together, which ought to consume, and from the experiments does consume, a considerable amount of power.

Mr. MacCormack made in this connection a most interesting contribution to the discussion. On the Cleveland system he undertook the investigation of possible slip. by putting cyclometers on the wheels so as to count the relative revolutions of the driving wheels and the rolling wheels on the same car in a given run. Not only did he find most unmistakable evidence of slip of the driving wheels, but in some cases found this slip rising to very considerable amounts. Of course, the nearer to the limit of adhesion one is working the more probability of getting grinding action between the driving wheels and the track This cause alone is sufficient to account for the difference which has been observed between the power required for four-motor and two-motor equipments. In addition to this, the four-motor equipment generally is more liberal in its capacity than the two-motor equipment, so that there must be some little difference in the average efficiency of the motors while in service, a difference probably not large, but perhaps enough to accentuate the difference between driving two and four axles, to which we have just referred.

And this brings us to the second important point in the discussion, and that is, the relative repairs in the case of two-motor and four-motor equipments. In spite of the fact that the four-motor equipment is more expensive and more complicated than the two-motor equipment, the discussion conveyed a pretty definite impression that the depreciation actually found in the four-motor equipments was materially less than in the case of two-motor equipments, enough less in the opinion of some experienced managers to offset the difference in cost of the two forms of car equipment. This statement, if borne out by further investigation, is most important, giving a strong additional reason for the employment of the four-motor equipments. It is, however, very difficult to see why there should be a difference in wear and tear in favor of four motors rather than two, assuming the motors to be of equally good construction. In the one case there are four commutators and a doubly complicated set of connections, as against two commutators and the ordinary controller in the other case. On form, as our sporting friends would say, there would be every reason to expect a greater depreciation with the greater number of motors. It is a subject which would be worth careful investigation at the hands of the Street Railway Association, for it is one of vital importance in the extension of street railway practice which is now going on. On the facts set forth up to the present, we are rather disposed to doubt any intrinsic advantage in the matter of depreciation to be gained by the use of four motors. There are two causes which would tend to produce this impression without proving the case in any general way. As a matter of fact, most four-motor equipments are materially greater in power capacity than the corresponding two-motor equipments with which comparison would have to be made. That is, assuming the two-motor equipment to consist of two 40-hp (nominal) motors, one is very much more likely to find four 40-hp motors on the four-motor equipment, than four 20-hp motors. Now, assuming the maximum continued power demanded from the car to be 100 hp, in the one case we would have two motors working on 20 per cent over-load, while with four 40-hp motors we would have an equipment working far below its rated capacity. It, therefore, would work somewhat less efficiently at light loads, but would suffer much less at maximum load conditions. In other words, taking two-motor and four-motor car equipments, not as they might be, but as they generally are found in practice, the conditions which lead to a desire for the advantages in acceleration to be gained by the four-motor equipment, indicate that the two-motor equipment is being hard pushed in one way or another. It therefore seems more likely that on an average the four-motor equipments are run less frequently at over-load and more steadily at loads well within their powers. The comparison thus does not directly involve the presence of two motors or four motors per car equipment, but the relative merits of over-loaded and moderately loaded motors in point of resisting wear and tear. Under these circumstances the favorable results in depreciation which seem to be generally reached with four-motor equipments, are very readily understood.

Another fact which may have its bearing on this question is the comparatively recent development of four-motor equipments. When a company undertakes comparison between the repairs of its two-motor and four-motor equipments, it will in most cases be comparing four-motor cars recently put on with two-motor cars which have been some time in use. Now, depreciation in such apparatus is not a constant quantity per year, but usually an increasing quantity with the age of the equipment. Hence, unless great care be taken in such a comparison to valuate the repairs on two-motor and four-motor cars which have been in service about the same length of time, the results will decidedly favor, at the present time, the four-motor cars, which, on the average, have not been in use so long. These two causes probably furnish a sufficient explanation of the facts brought out in the discussion, so far as it related to depreciation of equipments.

As regards the matter of power consumed, it would be worth while for some company, or better yet, a committee of the association, to investigate carefully the cause of the extra power which seems to be required with the four-motor equipments, with the purpose of finding out how much of this extra power is due to the increased number of driving wheels, and how much may be chargeable to differences in efficiency of the motors or in other service conditions. As we have already indicated, both of these causes are probably involved, although we are inclined to attach by far the greater importance to the former. In

any event, the extra power required must not be considered in the light of a general argument against the use of the four-motor equipments. The manager who employs them employs them for a specific purpose which he accomplishes, and which frequently he could not accomplish by any other means, and the extra power required is merely part of the price paid for the useful result.

The Future of the American Street Railway Association

We believe that the American Street Railway Association has reached a critical period of its existence. No one appreciates more than the STREET RAILWAY JOURNAL the valuable services which it has rendered in the past to its members and to the street railway industry as a whole. This paper and the American Street Railway Association were started at nearly the same time, and have grown together with the industry which they both represent. The association always has, and always will, receive our heartiest and most loyal support, for we believe in united action and consider the association the most potent agent in securing those ends which can only be gained by the co-operation of all the members of an industry. The question is whether the association will rise to the emergency which now confronts it. It cannot stand still, and if it is to advance, as it has in the past, it must face the situation as it exists to-day. There has been no time in the history of the industry when more problems which require immediate attention have been presented to the electric railway manager; problems of management, of relations with employees, of construction and of operation, which must be solved. Most of these demand more attention and more knowledge than can be commanded by any one railway company. If all are to participate in the benefits, all should contribute to the end sought.

We do not wish to appear captious in considering the work of the association. The Kansas City convention was successful, and we do not believe that any person who went to Kansas City returned with any feeling except that he was repaid and more than repaid for the time and expense of making the trip. The association is performing an important service to its members and the street railway industry in general. The only question is whether it cannot be of more benefit to the immense capital which is invested in street railroading in this country, and consequently to the many employees and others who are directly and indirectly connected with the electric railways of this country. Even with the sessions of the association reduced to three instead of four, or two working days instead of three, as in the past, an ample opportunity is given to treat a large variety of subjects which interest vitally the railway managers of to-day. The sessions should commence promptly at 10 o'clock certainly, and if possible, earlier. Additional time can be secured by publishing the papers beforehand, and by reading them in the abstract in the case of long papers, as suggested elsewhere. In this way three or four times as many papers could be presented as is now the case, and an ample time could be had for a thorough discussion of them all. These discussions would bring out the practices of other companies besides the one described in the paper proper, and in this way the sum of the experience of the entire body would be presented to the manager to assist him in overcoming many of the knotty problems with which he is now confronted. Informal discussions on pertinent subjects connected with street railway conditions could also be introduced to advantage. This method was introduced several years ago by the New York State Street Railway Association, and was found to be productive of the best results.

But it is not only in the literary work at the convention itself that the association could assist the everyday labors of the street railway management. Where special information is required committees could be appointed made up of representatives from the leading companies to carry on tests through the year, the results of which could be reported to the association at its next annual meeting. In this way a basis could be arrived at for intelligent action on the care and selection of appurtenances used in the street railway service. Other organizations are conspicuous in this united work for the common good, and their activity is fruitful of results. Oftentimes these committee reports are the most valuable features of the convention. It is not necessary that such reports should be laid before the general public; some of the most necessary work may be upon topics only suited for executive session. But the vital thing is united, persistent effort for mutual benefit. The American Street Railway Association is probably freer from commercial rivalry among its members than any similar organization, and by so much the more should there be only free interchange of opinion and experience. Above all, if it has chanced that a certain member has been thrown in the way of securing unusual information on some particular point, he should be induced to give it to the association.

There is no lack of suitable topics for study. Two most pertinent ones we have already noted in commenting upon the question of four-motor *vs.* two-motor equipments, questions which could with advantage be turned over to a committee to investigate. A general discussion of the brake question or of the grounded circuit would be of immense value if the members could be allowed or coerced into telling their experiences. It might have to be held in executive session for the sake of peace, but that is one advantage of such sessions. Free and full discussion is the important thing, and the hardest to attain. Once in a while some one gets up and bluntly states the facts, whether they are palatable to his auditors or not, and a single such statement in a discussion is worth half a dozen smoothed and edited reviews on the same subject. Aside from these technical matters, there are even graver matters of concern. Just now street railways, in passing through their evolution from urban to interurban roads, are, in their public relations, between the devil and the deep sea! There is an altogether unfortunate tendency, merely because a road is doing interurban service to the great convenience of the public, to thrust upon it the responsibilities and inhibitions that belong to great trunk lines. It is the proper function of interurban roads to afford a degree of cheap and facile rapid transit that has never been reached by any other means, and the road is ill requited by hampering its progress. The relations between interurban roads, as well as city roads, and the public, with means for their betterment, is a subject which is well worth the most careful attention of the ablest committee which the association could organize.

Again, the three-cent-fare craze takes occasional possession of the political under world by spells of unhappily increasing frequency. A standing committee to undertake a campaign of common sense and education would go far toward averting the need of combating such attacks by costly and disquieting litigation. These and many topics, such as wages, hours of labor, and others which readily suggest themselves, might properly be made part of the active life of the association.

Notes and Comments on the Street Railway Accountants' Convention

BY A. O. KITTREDGE, F. I. A., C. P. A.

There are at least two plans upon which a convention may be discussed: One is to be present in person, to listen to the papers read and the discussion that follows, taking copious notes meanwhile, and then to reduce to writing one's conception of the affair, pointing out those features that are most striking and interesting, and making such comments as the occasion may seem to warrant. The other is to observe the convention from a distance, to read in cold type the carefully prepared papers that were submitted and the discussions which followed, and then to write out one's impressions. Both plans have advantages. In the one case the commentator is liable to be carried along, as it were, by the current of argument, and thus in a sense becomes a part of the convention—that is, a partisan disqualified for impartial discussion. In the other he remains entirely dispassionate, and is in an excellent position to assume the semi-judicial point of view so desirable to occupy, weighing carefully the arguments pro and con, to the end that he may point out conclusions and clearly indicate the trend of events. It is not every convention that knows which way it is drifting, to say nothing about the course it is trying to steer.

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At the last moment I found it impossible to attend the convention of the Street Railway Accountants' Association, assembled at Kansas City on Oct. 16, although I had expected to be present. It was a disappointment to me, because my attendance upon the previous conventions of the organization, together with more or less special committee work, in which I had the pleasure of co-operating, has made me many pleasant acquaintances among the members of the organization whom it would greatly please me to greet once more. I know that I should have greatly enjoyed all the exercises of the occasion. Notwithstanding that I was not present, the editor of the Street Railway Journal tells me that my comments on the proceedings of the convention are desired, and therefore he urges me, in the light of a careful reading of the papers which were submitted and a perusal of a verbatim report of the discussion, to present running comments, very much the same as I have done for several years past in the issues following the conventions. I am somewhat reluctant to do this, but can scarcely decline so hearty an invitation, and if, as he says, the accountants are at all interested in what I have to say on this matter, I am sure I have no good reason for withholding my remarks. In addition to reading the proceedings of the convention, I have had the opportunity of conversing with some of those who were present, and in the light of all that is before me, I shall attempt to reflect in these long-distance notes some of the impressions made upon my mind by what was done.

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The accountants are to be congratulated upon the good impression they made upon various men prominent in what is familiarly called the regular convention. Viewed from my distant standpoint, it would seem that the accountant's convention was specially characterized by promptness in getting to work on each of the several days, by businesslike methods throughout all the sessions, and particularly by the lively and interesting discussion which followed each of the several papers that were presented.

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If I may believe the reports that reach me—and certainly no one is interested in anything else than stating the exact truth—President Duffy acquitted himself as presiding officer with even more grace and dignity at this convention than on any previous occasion. His reputation in this regard was already very high. The accountants are to be congratulated in having had so able a presiding officer, one who is so thoroughly in touch with everything that is up for discussion, who is sympathetic with the audience, and who personally knows the rank and file of the members of the association so well. Mr. Duffy not only retires with high honors, but has set the pace for his successor, who has been his co-worker in this organization from the very start. Mr. Ham will no doubt be equal to the occasion, for in a sense he has long been in training. Nor is the association likely to lose the energetic and intelligent work of Mr. Duffy, for as chairman of the executive committee he is likely not only to find plenty to do, but also to be able to exercise a potent influence for good upon the affairs of the organization.

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I hear many words of praise for Secretary and Treasurer W. B. Brockway, formerly of Toledo, and now of the New Orleans & Carrollton Railway Company, New Orleans. His businesslike methods, his indefatigable industry, his modest and unobtrusive ways, the thoroughness with which his reports are made up and his exhibits arranged, together with numerous other high qualities, endear him to the officers of the association, as well as to the rank and file of the members. In many respects Mr. Brockway is an ideal secretary. The association is to be congratulated on having found him, in the first place, and, in the second place, in being able to retain him in office year after year.

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The new officers which the association has chosen are men who are likely to infuse new life and energy into the various parts of the work. The association will gain by the change that has been made, not because the old officers were inefficient—quite the contrary—but because "a new broom sweeps clean," and because there is enthusiasm and inspiration among new leaders. Each of the officers in whose hands will be the work of the organization for the ensuing year has had a long and special experience or training. Each is in a responsible position in the field of practical street railway work. Each has clear-cut ideas of what he would like to see the association accomplish, and each has a clear conception of the good that the association can do in the field in which it is working. The Street Railway Accountants' Association, under the management of Messrs. Ham, Harder, Smith, McDole and Brockway, assisted by the executive committee headed by Mr. Duffy, is in most excellent shape for a larger and broader and more useful service than it has ever before achieved.

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The keynote of the usefulness of the association was very happily expressed in the brief remarks of Mr. Ham, when Mr. Duffy called him to the platform, and, in his own language, "turned the chair over to him." Modesty is

Mr. Ham's besetting fault, and therefore he was not expected to say as much as he might. However, what he said was right to the point. I quote: "If I have done anything for the association, it has done tenfold more for me. I believe that any man who comes to the convention of our association is greatly benefited, and that his company is also benefited. It is by coming in contact with other men in the same line of work that we are enabled to free ourselves from the dust and cobwebs which accumulate in our brains." The "tenfold more" that the association has done for Mr. Ham means, I take it, the advantages which it has afforded him in the way of coming in contact with his fellows and benefiting from the attrition of minds. Mr. Ham on this occasion very clearly expressed his conception of the future of the association. It is that the work of the organization from year to year will come to be more special and that the members will come into closer and closer touch with the operating department, thereby being made more valuable to street railway work, and that in time the "position of the accounting officer will become more dignified and more honorable than at present." This is an object well worth working for. I notice particularly that Mr. Ham puts first in order the use that the members may be to the industry with which they are associated, and last, the advancement which is to come to the individual worker.

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The only criticism that I can justly offer at this time concerning the work of the association is virtually one that has been repeated in these columns on several occasions in the past. The organization is styled an accountants' association. Its object ostensibly is a standard system of accounts. The methods discussed and the real work so far done, however, are in the realm of bookkeeping, rather than in that of accounting. No one can quarrel with the members of this association for styling themselves accountants rather than bookkeepers, for they are in fact the accounting officers of the companies that they represent. Under them, as their employees, for whom they are responsible and whom they are directing, are bookkeepers and cashiers, voucher clerks, ledger clerks, and so on to the end of all the classes of help that their offices require. They are accountants, and are entitled to the name. But the time of the association so far has been largely devoted to a discussion of mere account classification, or, to be more particular, to expense account classification, and not to real accounting. They have given attention to bookkeeping details rather than to real accounting. There has been lacking in the work of the association a definition of accounting principles applied to street railway work which would serve as the logical foundation for the expense classification that has been adopted. The absence of a declaration of the accounting principles to which the members could subscribe—in other words, the absence of a formulated accounting creed, if I may use the term—has been the reason for various misunderstandings that have occurred, and is the cause of a certain amount of bewilderment at present. With a skeleton exhibit of the accounting system of a street railway, worked out and adopted, being something to which, as before stated, all could subscribe, there would be very little opportunity for the differences in opinion which now exist concerning certain points. It would be the ready key to the solution of various problems which the association has yet to meet.

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The line that divides bookkeeping from accounting, or that distinguishes the interpretation of details from the principles upon which those details are based, is so subtle that many persons fail to perceive it. Perhaps subtle is not the word to express the idea. It is as though the boundary line were represented by an elastic cord. Those who happily jump over the cord, thus passing from the realm of bookkeeping and routine detail into the realm of accounting principles, find themselves in a new world, while others, who, instead of jumping over the cord, push against it, apparently make progress into what would seem to be the new territory, but which is obscured to them because they have insensibly carried along with them the fog of their old location. Such persons, further, are all the time restrained by the cord, elastic though it be, against which they are pressing. They are never released from its confinement until they are able to leap over it, until they experience a new life. If the distinction between bookkeeping and accounting is so hard to perceive by those who are in active work, it evidently must be harder to describe in an article of this kind. Therefore, I shall not attempt it. I merely point out that the association in this regard apparently still stands just where it did one, two and three years ago.

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One more thought, however, in passing, and that is that perhaps the time will come when some one out of the ranks of the organization will rise up with a paper on the theory of street railway accounts, that shall be so clear that his hearers will at once see the new light. Perhaps he will see his way clear to a discussion of principles entirely divorced from blanks and forms, cash books, ledgers, statements and reports, and be able to lead his hearers into a consideration of street railway accounting in the abstract, thus indicating what it is the object to produce by means of the details attendant upon daily work, but leaving out of consideration for the moment all methods whatsoever. If the officers and members of the Street Railway Accountants' Association were able to agree upon such a theory and were to succeed in getting it properly charted, they would find their differences disappearing one by one, and each particular idea that is advanced taking its proper place. In saying this I do not mean to intimate that there are essential differences between the members at the present time, but that in the presentation of ideas and suggestions there is no scheme of classification in vogue in the organization that serves to show where they belong. I wish for the good of the association there were more differences of opinion than there are at present. The fact that there are so few differences and that the majority of the members are apparently satisfied with things as they are is opposed to the best interests of the association rather than an indication of work completed.

To sum it up, the agreement upon a theory properly charted as above suggested, would help wonderfully in discussing such questions as units of comparisons, departmental accounts, materials and supply accounts, etc. There is a variety to the discussion at present, because each man proceeds with his work from his own particular point of view, without any regard to limits and without any definition of fundamentals. By the new plan each man would be confronted by what may be likened to a pigeon-hole system, with the suggestion that at the outset he indicate in what divisions it properly belongs. This preliminary agreed upon, the discussion could proceed to advantage. Some one should have taken the idea from Mr. Beggs' paper entitled "What Does the General Manager Want to Know from the Accounting Department?" and have risen to the occasion at once. What the general manager wants to know, as Mr. Beggs pointed out, is easily reduced to a formula. It is something constantly recurring, and it is something for which there must be a scientific reason in every detail. A theory of street railway accounts, properly

declared and defined and expressed in a chart, would be the best exemplification of an answer to Mr. Beggs' question.

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The exhibit of blanks and forms, which has been a leading feature of the association's annual convention for several years past, received more attention, I am told, this time than on any other occasion. As time goes by, the collection becomes more and more complete, and in the sense of a mere display is of greater interest each succeeding year. I am told that the blanks contributed by the Glasgow Tramways, an enterprise, by the way, that is owned by the municipality, excited special interest. Various members, I am informed, claim to have got new and valuable ideas from their study of the blanks on this occasion. No doubt every one who examined the blanks, if questioned, would admit more or less advantage in this respect. I have always regarded the effort of the association in this particular, however, as of very limited utility, for it seems to me that a blank, to be of any real value, must be a clearly defined part of a complete system. In street railway work, as well as in almost every other line of business that I have ever investigated, I find in use many curious fragments of systems and the blanks in general characterized by the absence of a comprehensive system. This brings us back to the fundamental need in all the work that the association is doing—namely, a skeleton of an accounting system of which the blanks shown would be merely the working parts.

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The genesis of a blank in street railway work, as well as in any other branch of business, is something of interest. Some person at some time or other, for some particular reason, wants some special item of information. Thereupon, either personally or at the hands of an assistant, he produces a form that is calculated to secure the information desired. The relationship of that form to the whole accounting system, or to other blanks which are already in use, is, as a rule, far less thought of than the immediate want it is to satisfy. Accordingly, very often information is duplicated, although perhaps changed in form of presentation. The work required in filling out the report is not only duplicated, but in many cases quadrupled, simply by reason of the conflicting forms of blanks in use and the conflicting requirements in the work of filling them out. It is like adding on to a house rooms for the accommodation of people of peculiar ideas, the work proceeding not under the charge of an architect, but under the management of the persons who are to occupy them, and who, as a fact, are inexperienced in both designing and building. It would be a very peculiar looking house and of doubtful sanitary qualities.

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It is plain to see, therefore, that blanks and forms, to be of the greatest possible use, must be devised as working parts of a carefully designed system, each particular blank being considered with reference to all the others, to the end, first, that the information sought to be conveyed shall be presented in the best and simplest form, and second, that for no reason whatsoever shall clerical work be duplicated. There are very few forms and blanks in use, save only those which have been designed upon the principle above laid down, that do not embody features which make them expensive in preparation and cumbersome in use. The ideal blank is simple in form, and is so related to the general system as to receive the special information it is to present to the management without the requirement of extra labor in searching for the information. I like to regard the blank—using the term now particularly in the sense of a blank for a statement of results—very much as a ledger account, being that into which items will be posted in natural course from properly designed posting mediums. I have very little sympathy with the statement form that requires the abandonment of all the regular bookkeeping work of the office and a digging after facts along original lines of investigation for the purpose of finding it out. Yet there are many such forms in use. To the student of accounting systems—using the term "system" now in the sense of a complete working plan—the library of blanks accumulated by the accountants' association is of great value. To the so-called "practical," but incomplete man, who, without scientific basis for his selection, is disposed to pick up various fragments and attempt to put them into practice in his own office, the collection may prove a veritable stumbling-block. It all depends upon the use that is made of it.

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The recommendation of President Duffy that a committee should be appointed, charged with the work of preparing model blanks and forms general in their adaptability to use, with such explanations and instructions as may be necessary and desirable, shows that he, for one, appreciates what may be derived from the collection of blanks now in the possession of the association that will be of advantage to all the members. It also indicates that he is aware of the danger that comes from the indiscriminate use of bright and attractive looking fragments. And yet, without knowing more of the idea that was in Mr. Duffy's mind than can be derived from the report that is before me of his annual address, it would seem that he has not gone to the root of the matter. As above said, before the blank can be intelligently devised, whether it is to be general in its application or specific, there must be present the skeleton or outline of the accounting system of which it is to be a part. The standard accounting system—using the term "accounting" now in the sense of defined theory and application of principles, rather than in the sense of classification of accounts and applied bookkeeping, and the word "system" in the sense of something complete—is the one thing that as yet the association has not seriously inquired into. The proceedings of each annual convention, however, show that gradually this subject is being approached, and there is reason for hoping that before long it will not only be reached, but taken in hand and ultimately settled to the satisfaction of both the managers standing for the capital invested and the accountants responsible for the detail work of their departments.

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To the ordinary layman, who for the first time inquires into the affairs of the Street Railway Accountants' Association, it must be a matter of astonishment that the membership at the end of four years is less than one hundred. When the number of street railways in operation throughout the United States, Canada and other parts of the world is considered, and it is right that we should take in other parts of the world, in view of the foreign membership which the association already has, one would imagine that this organization would be very much stronger numerically than it is at present. Looked at from another point of view, the membership is perhaps quite as large as could be expected, for in street railways, as in other industries, there are many persons engaged who have neither the capacity nor the ambition, the leisure time nor the inclination to co-operate in a movement calculated to advance the industry. It is only the leading, the more progressive and the really aggressive men in any branch of business that get together for the good of that business broadly.

(To be Continued.)

CONVENTION PAPERS AND REPORTS

Consolidation of Street Railways and Its Effect Upon the Public

BY DANIEL B. HOLMES

It is no part of the purpose of this paper to enter into an extended discussion of street railway consolidations from a legal point of view. It is assumed that no considerable number of those present would be particularly interested in that branch of the subject. Suffice it to say that the laws of nearly, if not quite, all of the States of the Union are in such condition that practical street railway consolidation may be brought about and made effective by union of companies as a technical consolidation, or by purchase and sale of the corporate property or capital stock or by common ownership of the corporate shares of several companies, or in other ways which might be mentioned. Whenever consolidation is desired by the parties in interest, it may be safely assumed that counsel learned in the law will find little or no difficulty in pointing out the way in which that end may be legally accomplished.

Street railway companies may be properly classified as public service corporations, and whenever a union takes place of several such companies, it at once becomes obvious that the interests of the capital invested and of the traveling public may, and probably will, be positively affected thereby. Therefore, these two interests will form the chief basis of what I have thought proper to lay before this convention of practical street railway men, whose calling is such that they never feel at liberty to disregard either the best interests of their stockholders or the welfare of the dear public, whose constant servants they are. And I may be permitted to ask, in the light of an experience and intimate association with street railway managers extending over a period of upward of twenty years, that no class of men with whom I have come in contact in the active practice of a profession which brings about the most intimate relations with all sorts of men, are so constantly mindful of the best interests of the public they serve by night and by day as the street railway men. I am the more pleased to make this acknowledgment because the street railway man has so many impatient masters among the traveling public that he is much more often the subject of unjust criticism than of the well deserved encomiums he would surely receive if the difficulties of his situation and his conscientious efforts to faithfully discharge his company's duty to the public were even half-way understood. Above all men it is his lot to bear the "whips and scorns of time," and if he will but pin his faith to the teachings of the Good Book, he may expect to receive hereafter that reward which in but few cases, I am sorry to say, comes in this life in the shape of an adequate salary for so hard and thankless a job.

That the consolidation of street railway interests affords opportunities for the introduction of many various economics is a truth which is almost axiomatic, and this may be fairly said to have been the controlling consideration which has inspired and accomplished the many consolidations which have taken place in various parts of the country. By this process the managerial force is greatly reduced and the salary list largely diminished. Where three or four presidents, managers or superintendents were required for the successful management of the separate properties, but one officer of each kind is needed in their united state, and while he receives more salary than any one of his predecessors, as of right he ought, because of enlarged duties and more weighty responsibilities, still there is substantial saving over what was previously paid.

But there is, in this connection, a still more important consideration. As is the case with any other calling in life, the supply of really first-class street railway managers is more or less limited, and the larger salary offered by the consolidated interests naturally commands, and in all probability secures, a higher order of talent than the separate properties could retain even where it had been fortunately possessed. In this way, the consolidated properties in nearly every instance are managed with greater ability than was shown by the management of the disconnected parts, and this is a positive gain, the value and importance of which can scarcely be estimated. This successful manager, you may be sure, is truly a remarkable man. The relations existing between street car companies on the one hand, and the municipality or its citizens on the other, are the fruitful source of jealousies and complications constantly arising which can be successfully disposed of by nothing short of the possession of genius for diplomacy, and for affairs and finance all at the same time, in order to be able to satisfy the demands of the public without involving the company in irretrievable financial ruin.

In most instances the consolidation of street railway properties creates opportunities for marked reduction in the cost of generating motive power. Location is a most important consideration as regards the power station. Unless the power station is so situated that both fuel and water can be delivered to it at minimum cost, the highest degree of economy in developing motive power is altogether impossible. This is greatly facilitated by the union of properties, since the car lines are so situated in most cities that but few of them, if independent, could operate from power stations located near steam railroad switches and water courses. A greater or less number of high-priced employees are always necessary around every power station, whether large or small, and this is an expense which is greatly curtailed by generating as much power as is practicable to handle from one station. A company possessed of an extensive system with large mileage has thus presented to it the opportunity of producing power at the minimum cost, a thing altogether impossible on a short-line railway.

But perhaps the most important result from consolidating street railway lines is the great stimulus it affords to street railway traffic. Outside of a few of the very large cities, where the problem is not how to get business, but how to successfully handle that business, which, of necessity, must come to the car lines, the street railway companies are quite generally engaged in efforts of all kinds to create travel on the lines artificially by offering to the public attractions of various and sundry kinds. This is all well enough, but one of the most effective means to this end is the consolidation of the street car lines. I believe it is the uniform experience that the aggregate travel on the united lines exceeds by a large percentage the business formerly done by the separate properties. This is partially accounted for by the fact that short distances are now ridden which were formerly walked, because two fares were then necessary in order to ride, and this was considered too great an outlay for the accommodation afforded.

But how stands the case with the public? I am altogether sure it is no different. Indeed, the immediate benefit to those who ride upon the cars far exceeds the increased returns to the consolidated company. Where, before the union, two and even three fares in some instances had to be paid in order to convey the passenger to his destination, he may now take the same journey for a single fare by means of transfers and through cars, which was previously impossible. Taking Kansas City as an example: 50 per cent of all the passengers who ride on the cars make at least one transfer in every journey, so that it may be truly said that 60,000 passengers save 5 cents each, and every day in the year in Kansas City alone, and this saving is due solely and directly to the consolidation which took place only a few years ago. And who are the people thus benefited? It is chiefly the laboring classes who can least afford to spend their hard-earned gains unnecessarily. The sons of toil who were formerly compelled to shelter their wives and rear their children in the polluted air and noise and smoke because unable to pay more than a single fare in going to and from their avocations, can, and do now, dwell in the neat little cottage in the suburbs, where loved ones breathe the pure air of heaven and bask in the sunshine of life all the day long, and when eventide comes, smiles and mirth and joy are the companions who have taken the place of sickness, suffering and grief. Who can estimate the value of blessings like these? If the public welfare is the first and highest duty of the State, who can gainsay the immense value to the public of street railway consolidations, and who can say that the State ought to throw any obstacles in their way?

But it is said that competition is the life of trade, and that monopolies are odious. Accepting these as general truths, let us see how it is with the street railways. Except to a very limited and unimportant degree, there is no such thing as competition in street railways, and their consolidation is entirely devoid of any objectionable feature of a monopoly. In the very nature of things street railways are seldom competitors in business. They were never known to compete in rates, and can only be laid on such public highways as the authorities may determine. The necessity for keeping some streets open for ordinary vehicle traffic keeps the street railways sufficiently far apart, as a rule, as to eliminate any matter of choice on the part of the intending passenger. Each line supplies and accommodates its own peculiar territory, and there is no real choice, and hence no real competition. As to rates, these are universally fixed by the franchise ordinances. They are the

same on all roads, so that the intending passenger is moved in his choice solely by consideration of convenience to himself. In short, he simply takes the line that carries him to his destination with the least inconvenience. Monopolies are only odious when of a character that they do or have the power to fix their own price for what they alone can sell. Not so with the consolidated street railway. So far from having the power to increase the cost of travel, consolidation always results in a practical reduction of cost by giving to the passenger the right to ride for the same single fare the increased distance brought about by the consolidation. No thoughtful man would condemn a street railway consolidation, because it neither stifles competition nor increases cost of travel, nor creates a monopoly, as that term is generally understood.

There can be no doubt that consolidations of this character are greatly beneficial, both to invested capital and to the public at large. And, happily, this is so, because the public is never so likely to have its wants provided for as when it is to the interest of capital to do so. There is no tie so strong as common and mutual interest. This is a principle which would render many conflicts and controversies impossible, if kept always in mind and strictly adhered to in all dealings between public service corporations and the municipality in which they dwell. I commend it to the thoughtful consideration of all who are assembled in this convention as the firm foundation on which aggregations of capital may safely rest, the Gibraltar of justice and right, garrisoned by an always sound and healthy public sentiment, against which the assaults of prejudice, passion and demagogy would be hurled in vain.

Comparisons of the Various Systems of Electrical Distribution for Street Railways

BY C. F. BANCROFT

In preparing a paper on "Comparisons of the Various Systems of Electrical Distribution for Street Railways," I find that the conditions to be met in the numerous localities where the various systems are in use are so widely different, and each system so generally satisfactory under certain conditions, and so completely unsatisfactory for meeting other conditions, that comparisons are altogether impossible, except in a very general way.

There are six systems of electrical distribution for street railways at present in more or less general use.

First, what may be called the standard 500-volt continuous current system, where the current is generated at from 500 volts to 600 volts and delivered direct to the car motors, usually by means of a feed wire and trolley, third rail or underground conduit.

Second, what may be called the alternating, direct-current system, where the power is generated as alternating current, usually at high voltages of from 5000 volts to 15,000 volts, and transmitted to sub-stations, where the voltage is usually reduced by means of static transformers, transformed into direct current by rotary converters, and delivered to the lines at about 500 volts continuous current.

Third, the "booster" system, where the current is generated usually at about 550 volts, and where, by means of an auxiliary generator, usually series-wound, called a "booster," additional voltage is generated and compensates for that lost on the line.

Fourth, the so-called three-wire system, where the current is generated at about 1000 volts, usually by means of two 500-volt generators connected in series, and is delivered to two motors or two groups of motors in series.

Fifth, the alternating-current system, where the power is generated as alternating current, usually at high voltage, and transformed down to about 500 volts at the trolley wires by means of static transformers which may be located on the poles supporting the feed wire and trolleys, the cars being equipped with alternating-current motors.

Sixth, the storage battery system, where the batteries are carried on the car and charged at the power house or at special points on the line. Storage batteries can also be used to advantage in connection with any of the above systems under certain conditions, and, in fact, combinations can be made of any or all of the above systems.

For any given conditions as to speed, traffic and length of line, some one of the above systems is likely to be much better fitted and more efficient than any of the others; therefore, it seems to me that a comparison of the various systems can best be made by considering the particular conditions most favorable to each. In the distribution of power for street railways the result to be aimed at is usually the maintenance, at variable loads, of an approximately constant pressure of 500 volts on the trolley wire at a minimum total cost for power.

The cost of generating electric power under the same conditions, as regards fuel, depends to a great extent on the amount of power generated and the capacity of the generating apparatus with reference to the average output required. Under ordinary operative conditions, with the same power factor, that is, the same ratio of output to capacity, the cost of power per kw-hour from stations of less than 500-kw capacity increases very rapidly as the station decreases in size. With from 500-kw to 1500-kw capacity, the cost of power per kw-hour decreases slowly as the size of the station increases. From 1500-kw to 2500-kw capacity the cost per kw-hour decreases very little as the output increases, and above 2500-kw station capacity the cost of power per kw-hour becomes nearly uniform. This is due to the fact that in small plants the labor item is disproportionately large, and the general efficiency less than in larger ones, while in plants of 1500-kw output and larger the cost of labor remains proportionately nearly the same as the plant increases in size. It follows from this that there is often very little or nothing to be gained from an economical standpoint by substituting one station of 5000-kw capacity for two of 2500-kw capacity each, provided the local conditions, as regards cost of coal, water, etc., are the same.

The system of distribution most suitable to a particular road depends to a great extent on the location of the power station or stations and the nature of the load. It is always expensive to transmit power, the expense being either in interest on copper investment or in fuel or both; and, therefore, other things being equal, the location of the power station or stations should be as near the load center of distribution as possible. The location of the station is, however, usually governed to a considerable extent by local conditions as regards cost of fuel, water and real estate.

On a large system, requiring an average output of 12,000 kw, even though the load be distributed within a 5-mile radius of a practical station location, it will usually be found economical to generate this power at several smaller stations rather than at one large station, provided the conditions as regard cost of fuel, water and real estate are about the same, as the cost of power station buildings and machinery per kilowatt of capacity and the cost of generating power per kw-hour, with a station of 5000-kw capacity, is about the same as at a station of 10,000-kw capacity. The interest on the saving in cost of feed wire by having several stations, each located near its load, would more than offset the slight saving in cost per kw-hour due to the generation of power at one large station, and it also has the advantage that in case of fire or accident to one station the other can usually be so interconnected as to temporarily carry the entire load, and thereby avoid much of the stoppage of traffic which would occur if the road was supplied entirely from one station.

For an example of what was called the first or standard 500-volt continuous-current system of distribution, a city may be cited in which the street railway lines radiate west from the center of the city like the spokes of a half-wheel, with a radius of about 5 miles. Instead of having one large station at the hub of the wheel, the road is supplied with power from seven stations, distributed throughout the system, having an aggregate capacity of over 26,000 kw.

The generating and distributing system in use in one of our most densely populated cities may be taken as an example of the way in which the system of distribution adopted is governed by conditions outside of those indicated for the most economical generation and distribution of power to the car motors. Although this system is compact and will probably require an average station output of over 30,000 kw, which it would seem to the outside engineer could be more economically distributed and almost as economically generated at several stations, the street railway company is installing a high-tension alternating, direct-current system of distribution with a main station of 45,000-kw ultimate capacity, and five rotary converter sub-stations of from 3000-kw to 6000-kw capacity each. It is probable in this case that the location of the power station and the system of distribution was governed almost entirely by the great cost of real estate at points suitable for separate power stations.

It frequently happens that several miles distant from a street railway system much cheaper power is obtainable than at or near the center of the system. This may be due to an available water power, or to a difference in the cost of fuel, etc., at two points. In cases of this kind the second, or what may be called the alternating, direct-current system, is usually the most applicable. To transmit power at 500 volts in any quantity from a distance of 10 miles, or even less, is very expensive, owing to the large amount of copper required and the great loss. For instance, to deliver 500 amps. at 10 miles distance will require about 150 tons of copper, allowing a loss of about 30 per cent in the line. This same amount of power could be transmitted at 5000 volts by an alternating, direct-current system with about 5 tons of copper and with a loss of less than 10 per cent in the line.

The weight of copper required to transmit power a given distance, other things being equal, is inversely as the square of the

voltage, that is to say, if it takes 100 lbs. of copper to transmit a certain amount of power a given distance at 500 volts, it will only take 25 lbs. of copper to transmit the same amount of power the same distance with the same loss at 1000 volts. It is owing to this fact that the alternating, direct-current system is so applicable where the power has to be transmitted for any considerable distance, as it allows of the use of very high voltages on the line, 10,000 volts or more being in general use, which, by means of transformers and rotary converters, can be reduced to 500 volts direct current for the trolley wire at points where the power is required. For an example of this system of distribution, a street railway system may be cited which derives its power from a waterfall. Here the power is generated at a pressure of 2200 volts, and is stepped up to 11,000 volts for the line. About 6000 hp is transmitted at this voltage for a distance of about 21 miles. The voltage is then reduced to 500 volts, direct current, by means of static transformers and rotary converters at five sub-stations, located at or near the points where the power is required.

The third system mentioned, the "booster" system, is chiefly applicable on lines where there is a light average load, but where, for short periods, an extra heavy load has to be taken care of. It would seldom be economical to supply an entire road with power by means of a booster system, as the greater part of the power generated by the booster represents wasted energy, which is usually generated in an extravagant way, as the power required to drive the booster varies as the square of the current in the feeder, that is to say, if it requires 50 hp to drive the booster with a load of 100 amps., it will require 200 hp to drive it if the load is increased to 200 amps. Line losses which necessitate the continuous waste of more energy than could be compensated for by an ordinary compound-wound railway generator are seldom economical, even on a portion of a system, but there are many cases where there is sufficient copper installed to take care of the average load economically, but where for a short time each day, or for a few weeks in the year, owing to local conditions, the traffic is unusually heavy.

In cases like the above, where the heavy traffic is of short duration, a well designed booster system may save a large investment in copper at a total cost of much less than would be required to pay the interest on the copper investment. For an example of this method of distribution I might cite a street railway company which supplies power to its own lines by means of a standard 500-volt direct-current system, and which also supplies power to a smaller road about 13 miles distant by means of a three-phase alternating-current system, using 5500 volts on the line. Here the booster system is used in connection with the high-tension system. When it became necessary to repair the high-tension line, it was found expensive and inconvenient to do the work between the hours of 12 midnight and 4 a. m., the only time when the power was off, and as it was not considered safe to work on the line when it was in operation, a booster system was arranged to supply power to the distant road for short periods at times of light load. A 200-kw booster was installed at the generating station and was designed to raise the voltage 1 volt per amp. of current. Switches were installed at the sub-stations so that the high-tension line could be connected directly with the 500-volt feeders, some 8 miles from generating station, and the booster was arranged so that it could be readily connected to the high-tension feeders.

When it was necessary to replace broken insulators or make other repairs on the line the attendants were notified at the generating station and at the sub-stations, and at a prearranged signal, made by varying the voltage on the line, the alternators were thrown out and the booster thrown on in such a way that the power was only off from the trolley wire for a fraction of a minute. It was thus found quite practicable to make repairs on the line while the booster was in operation, and the system proved very satisfactory for supplying power at times of light load, while repairs were being made; the load on the booster frequently running as high as 500 amps., at which time the voltage generated by the booster was about 500, which in addition to the 575 volts of the direct-current system gave 1075 volts at the generating end of the line; the voltage at the sub-station averaging about 450. While it would have been very expensive to run this booster for any great length of time, for the short time it was used the total cost was much less than the interest on the copper investment required to build a duplicate line.

The fourth system mentioned, or three-wire system, is most applicable to double-track lines, where one trolley is made positive and the other negative, there being about 1000 volts potential difference between the two, the current flowing from the positive trolley wire through the car motors to the rail and from the rail through the car motors and the other track to the negative trolley. The track is usually cross-bonded and also connected to the conductor or connecting the two generators, which are operated in series in the station. This connection with the track forms the third wire, and tends to equalize the voltage should there be more cars on one side of the system than on the other. This method of distribution is usually capable of saving from 20 per cent to 40 per cent in copper, according to the character of the track return. If well balanced, it also greatly reduces the electrolytic action on buried conductors, such as water pipes, etc., and is most applicable where there are excessive track losses with fair opportunities for a balanced load.

There are few roads in this country using the three-wire system of distribution, although it is used almost universally by lighting companies. This is probably due to the complications introduced in railway systems by the high voltage, usually about 1000 volts, between the trolley wire and feeders on different sides of the system and the difficulty of balancing the load. The saving in copper, while not as great as in the three-wire lighting system, is still enough to warrant the extra complication, and under favorable conditions may prove very valuable.

I am only familiar with one example of this system of distribution. In this case there is very heavy traffic over a double-track line to a park, about 6 miles from the power station. It was found impossible to handle the increased traffic on the ordinary 500-volt system with the existing feed wire. By reinsulating the line and operating it on the three-wire system, the efficiency of the distributing system was very much improved, and they were enabled to easily handle the increased traffic with the existing feed wire.

The fifth system mentioned, or the alternating-current system, is practically untried in this country. It seems peculiarly adapted to lines having long runs at uniform speed with few stops, such as lines connecting cities, rather than for ordinary street railway service. The alternating-current motors at present in general use are of the polyphase type, and require at least three working conductors, which is a serious objection in many cases for railway work, as it necessitates the use of two trolley wires in addition to the track as conductors. The disadvantages of this system appear to be the necessity for at least two trolley wires and the probable difficulty in building alternating-current motors suitable for railway work which will have a good power factor.

The main advantage of the alternating-current system is the possibility of feeding lines with stationary transformers which need no supervision, but which can be considered simply as a part of the feeder, thereby multiplying many times the length of line which can economically be supplied with power from one station. The alternating-current motor also has the advantage of running at fairly constant speed independent of the load. It will not race going down hill if the power is left on, but will return power to the line, nor will it slow down much in going up hill. There are four or five railway companies abroad using this system, and judging from the reports that appear from time to time in the railway journals it is giving very satisfactory results.

The sixth system referred to, or storage battery system, is decidedly more expensive than the usual methods of electrical distribution, owing to the great first cost and the short life of the batteries. Lead is at present the only metal capable of resisting the attacks of sulphuric acid, and modern batteries consist largely of lead, which is very undesirable from a mechanical point of view and is very heavy, so that unless the present type of storage battery is substantially improved, this system is only likely to be used where other systems are not practicable owing to peculiar local conditions or restrictions. The storage battery, however, has a large field in connection with the other systems of electrical distribution for street railways, and under favorable conditions may considerably increase the station capacity and reduce the fuel consumption; and when used on the line may greatly improve the regulation and increase the copper efficiency.

From this brief outline of the various systems it will be seen that each has its peculiar advantages and that no one is suitable under all conditions. It will generally be found that where the traffic is heavy and the distance short, the standard 500-volt system is most applicable. For suburban work, where the distances are greater and the traffic less congested, or where it is necessary to transmit the power for some distance, the polyphase alternating direct-current system will usually be found more economical. In special cases, where, for short periods of time, an unusually large amount of power is required, the "booster" system will often prove very valuable, while for high-speed, long distance, interurban work the three-phase alternating-current system may be attractive. The cars on this system, however, would have the great disadvantage of not being able to run over the ordinary direct-current street railway lines.

There can be no general rule given that will determine the most advantageous system of distribution to use under the varying conditions to be met in street railway work. Each case must be considered as a separate problem and that method selected which will best meet the peculiar conditions involved.

Painting, Repainting and Maintenance of Street Car Bodies

BY F. T. C. BRYDGES

In giving my views as to the proper manner in which to paint, repaint and maintain street car bodies, I thoroughly realize that it is a subject of the greatest interest to street railway men; and as it is a part of my daily duty to supervise this class of work, the subject is of the greatest interest to me, and I will endeavor to give my views on the three topics separately.

Our object in painting a street car is two-fold: Maintenance and durability of structure, and appearance. It is needless for me to go into the question of the increased life and durability of a street car, when properly painted, repainted or revarnished as often as necessity may require to keep it up and maintain it in good condition, as it is an admitted fact that painting, repainting or revarnishing, as necessity may require, adds to the life and durability of street cars.

Our methods of painting new cars are simple, and, we think, very efficient. We apply our first, or priming coat, on all woodwork to be painted, then putty all nail holes and other imperfections, and then sandpaper the priming coat. In place of applying four or five coats of rough stuff to produce a surface, we apply one coat of glaze, or scrape-in coat, as I am of the opinion that the least number of coats of paint applied to produce a surface for painting the better. There is not so much danger then of the finished surface cracking and checking as when four or five coats of Japan or quick drying material are used to produce a surface with rough stuff, which, as a rule, is dry, brittle and non-elastic, and owing to the thickness of the four or five coats, is almost sure to check more or less within a short time after the work is finished. After the glaze, or scrape-in coat, is thoroughly dry, the same is sandpapered down close. The iron sill plates, in the case of open cars, are scraped in with the same quality of material, and then sandpapered in the same manner as the woodwork surface, the iron plates and all other iron work being thoroughly painted with best quality of Prince's mineral, mixed with raw oil, turpentine and Japan, as the first coat, to prevent rusting of iron. After the glaze coat has been thoroughly sandpapered to a smooth surface, we apply the first coat of body color, consisting of 10 lbs. of bleached white lead, 5 lbs. of Japan body color, and one pint of raw oil. We then apply the second coat of pure Japan body color and one coat of color varnish, sandpapering slightly with one-half or No. 0 sandpaper each coat of color before applying the next coat of color. Dashes and all iron work are painted with Prince's mineral, as above described, as the first coat, to prevent rust, and are then brought up in the same manner as the woodwork, except the glaze or scrape-in coat, which is omitted on all iron work. This exception, however, does not apply to sill plates or any part that is to be finished in connection with the body or wood work. After an application of a coat of varnish color, which is the last coat of color, the ornamentation and lettering are put on. We believe our style of ornamentation and lettering simple, and yet very neat in design. It consists of a fine line, a broad line and a small corner ornament worked into the fine line, making the ornamentation not expensive, but very neat in appearance. We are of the opinion that expensive and elaborate ornamentation on street cars is needless, a waste of money, and does not appear as well on the cars as a less expensive design. The great objection to expensive designs for ornamentation is not only their original cost, but it is more difficult to touch them up when damaged in service by some careless teamster who has punched a hole in the panel with the pole of his wagon, or scratched the entire length of the body and thereby damaged the side of the car. This class of car damage is a very frequent occurrence in large, crowded cities, and is much increased by careless teamsters. After the lettering and ornamentation are complete, we finish the entire surface with two or three coats of varnish of standard quality, the first coat being rubbing varnish if two-coat work, and the second coat being rubbing varnish if three-coat work, the last coat being finishing varnish. We do no rubbing with pumice stone on the rubbing varnish, as with street car surfaces we consider it unnecessary to waste time and money in rubbing down finishing varnish. We object to rubbing with pumice stone, as, in our opinion, it reduces to a certain amount the life of the varnish.

INTERIOR FINISH ON OPEN OR CLOSED CARS

Our rules for this class of work are as follows: Apply one coat of good wood filler for hard woodwork. Stain all soft woodwork for molding or otherwise to such tint as desired; clean up with fine sandpaper and apply a very thin coat of varnish, allowing it to stand about twenty-four hours. Then sandpaper and apply a second coat of coach rubbing varnish; then sandpaper lightly with No. 0 sandpaper and apply the third coat of varnish. We use no shellac on our soft- or hardwood finish. We object absolutely to the use of shellac in connection with car finish. We prefer to have the first coat of varnish applied on the wood next to the hardwood filler or applied on the soft wood. The backs of the panels are finished with two or three coats of good standard paint, applied on the canvas and other unfinished woodwork.

Roofs.—All roofs are painted with three coats of standard paint, or a good brand of white lead, tinted as desired.

Floors.—All floors are painted with two coats of standard floor paint or Prince's mineral paint.

Trucks.—All trucks are painted with one coat of Prince's mineral paint and one coat of standard truck color, striped to some extent if desired on trail cars.

Time Required for Painting Cars.—By following the methods described, cars, open or closed, can be painted and finished ready for service within eight days.

REPAINTING

Our system for repainting cars, so far as the painted surface is concerned, is about the same as described above. When their condition requires that the old paint be removed from the wood, we do so by burning off all the old paint. We then scrape the surface smooth to receive the priming coat, and then proceed in the same manner as described above with glaze coat, color, ornamentation and lettering. We then finish with the same number of coats of varnish as in the case of new work. If, however, the old paint is not cracked too much, and the surface has sufficient life to receive new paint, we clean up the entire car by thoroughly washing, then sandpaper the surface smooth and apply two coats of body color and a coat of varnish color, on which we apply our lettering and ornamentation. We then finish with one coat of rubbing and one coat of finishing varnish. We revarnish the interior with one coat of finishing varnish, except the seats and other hardwood surfaces of open cars, which we revarnish with one coat of varnish, one-half rubbing and one-half finishing. Two coats may be applied in the same manner if the condition of the car requires it.

MAINTENANCE OF CAR BODIES

Under this head I am of the opinion that the best manner to maintain the life of street car bodies is:

First.—At the car station from which the cars are run, have them properly and thoroughly washed every day with cold water and a good quality of pure non-alkali soap, prepared ready for use in liquid form at the paint shop of the company, or elsewhere. In all cases the use of warm water should be avoided, as if the water is too warm it will damage the life and appearance of the varnish. After the car has been thoroughly washed, all the varnished surfaces should be thoroughly rubbed dry to prevent water remaining on the varnished surfaces, and thereby causing damage thereto and shortening the life of the varnish.

Second.—I am of the opinion that all street cars, closed or open, should pass through the car shops once each year for general repairs. At this time they should be thoroughly cleaned, touched up and revarnished with one coat of varnish, interior and exterior, or with two coats of varnish if their condition requires it, and the roof should be painted with two good coats of white lead or standard roof paint. Floors, platforms and all canvas and unfinished interior woodwork should also be painted with two coats of paint, and the trucks and all iron work should be repainted with at least one coat of good standard paint.

Cost of Car Painting on the Camden & Suburban Railway Company, Camden, N. J.

Schedule submitted by W. H. Harrington, of Camden, in the discussion on car painting.

First class operation.....$28.00 contract
18-ft. body..... .10 bonus

1. Outside, burning off old paint.
2. " sandpapering.
3. " two coats of priming.
4. " four (4) coats of surfacer or rough stuff.
5. " rub to a smooth surface.
6. " first coat of color.
7. " second coat of color.
8. " color and varnish.
9. " striping and lettering.
10. " one coat rubbing varnish.
11. " one coat finishing varnish.
12. " blacking off iron work.
13. Roof, one coat of paint.
14. Inside dashers, one coat paint.

15. Floors and platforms, one coat paint.
16. Inside, one coat rubbing varnish.
17. Inside, one coat finishing varnish.

MATERIAL

6 sheets No. 1½ sandpaper	at	$ .04-10		$ .03
6 sheets No. 2 sandpaper	"	.½		.03
25 lbs. priming color	"	.06½		1.63
½ gal. Coralline, or rough stuff	"	2.50		1.25
16½ lbs. cream color	"	.06		.99
6½ lbs. special red	"	.46		2.99
4 books gold leaf	"	.35		1.40
1½ books aluminum leaf	"	.12		.18
2½ spools Coe's ribbon gold	"	.87		2.18
¼ lb. golden ochre	"	.25		.07
½ lb. sizing	"	.48		.24
¼ lb. white paint	"	.08		.02
¼ lb. drop black	"	.32		.08
¾ lb. Venetian red	"	.25		.19
2½ qts. rubbing varnish	"	3.50	gallon	2.20
2 qts. inside finishing varnish	"	3.50	"	1.76
1 qt. black iron varnish	"	.75	"	.19
2 gals. red rubber paint	"	1.17	"	2.34
2 qts. outside finishing varnish	"	4.04	"	2.02
				$19.79

Material, $19.79; labor, $27.90; bonus, 10c 47.79

Second class operation ..... $22.50 contract
16-ft. body ..... 2.41 bonus

1. Burning off.
2. Outside, sandpapering.
3. " one coat of priming.
4. " three coats of surfacer or rough stuff.
5. " rub to a smooth surface.
6. " first coat of color.
7. " second coat of color.
8. " color and varnish.
9. " striping and lettering.
10. " one coat rubbing varnish.
11. " one coat finishing varnish.
12. " blacking off iron work.
13. Roof, one coat paint.
14. Inside dashers, one coat paint.
15. Floors and platforms, one coat paint.
16. Inside, one coat finishing varnish.

MATERIAL

4 sheets No. 1½ sandpaper	at	$ .04-10		$ .02
4 sheets No. 2 sandpaper	"	.½		.02
14 lbs. priming	"	.06½		.91
3 pints Coralline, or rough stuff	"	2.50		.94
16½ lbs. cream color	"	.06		.99
6½ lbs. special red	"	.46		2.99
4 books gold leaf	"	.35		1.40
1½ books aluminum leaf	"	.12		.18
2½ spools Coe's ribbon gold	"	.87		2.18
¼ lb. golden ochre	"	.25		.07
½ lb. sizing	"	.48		.24
¼ lb. white paint	"	.08		.02
¼ lb. drop black	"	.32		.08
¾ lb. Venetian red	"	.25		.19
1¾ qts. rubbing varnish	"	3.50	gallon	1.54
2 qts. inside finishing varnish	"	3.50	"	1.75
1 qt. black iron varnish	"	.75	"	.19
2 gals. red rubber paint	"	1.17	"	2.34
2 qts. outside finishing varnish	"	4.04	"	2.02
				$18.07

Labor, $17.08; bonus, $2.41 ..... 19.49

$37.56

Third class operation ..... $14.00 contract
1.62 bonus

1. Outside, painting vestibule and dashers.
2. " cutting in all painted work.
3. " relettering and striping dashers.
4. " blacking off iron work.
5. " one coat rubbing varnish.
6. " one coat finishing varnish.
7. Roof, one coat paint.
8. Inside dashers, one coat paint.
9. Floor and platforms, one coat paint.
10. Inside, one coat finishing varnish.

MATERIAL

4 lbs. special red	at	$ .46		$1.84
8 lbs. cream color	"	.06		.48
2½ books gold leaf	"	.35		.88
½ spool Coe's ribbon gold	"	.87		.44
¼ lb. golden ochre	"	.25		.07
¼ lb. sizing	"	.48		.12
¼ lb. white paint	"	.08		.02
¼ lb. drop black	"	.32		.08
¾ lb. Venetian red	"	.25		.19
1 qt. black iron varnish	"	.19		.19
1¾ qts. rubbing varnish	"	3.50	gallon	1.54
2 gals. red rubber paint	"	1.17	"	2.34
2 qts. outside finishing varnish	"	4.04	"	2.02
				$10.21

Labor, $12.38; bonus, $1.62 ..... 14.00

$24.21

Fourth class operation ..... $8.50 contract
1.42 bonus

1. Outside, painting vestibules and cutting in dashers.
2. " touching up main body.
3. " blacking off iron work.
4. " one coat finishing varnish.
5. Roof, one coat paint.
6. Inside dashers, one coat paint.
7. Floors and platforms, one coat paint.
8. Inside, one coat finishing varnish.

MATERIAL

2½ lbs. special red	at	$ .46		$1.15
2 lbs. cream color	"	.06		.12
½ lb. Venetian red	"	.25		.13
1 qt. black iron varnish	"	.75	gallon	.19
2 gals. red rubber paint	"	1.17	"	2.34
2 qts. outside finishing varnish	"	4.04	"	2.02
2 qts. inside finishing varnish	"	3.50	"	1.76
				$7.71

Labor, $8.50 ..... 8.50

$16.21

Fifth class operation ..... $4.00 contract
.66 bonus

1. Outside, touching up dashers and main body of car.
2. " blacking of iron work.
3. " one coat finishing varnish.
4. Roof, one coat paint.
5. Inside dashers, one coat paint.
6. Floors and platform, one coat paint.

MATERIAL

1½ lbs. white paint	at	$ .08		$ .12
1 lb. special red	"	.46		.46
1 qt. black iron varnish	"	.75		.19
2 gals. red rubber paint	"	1.17	gallon	2.34
2 qts. outside finishing varnish	"	4.04	"	2.02
				$5.13

Labor 4.00

$9.13

Address of President of Street Railway Accountants' Association of America

BY C. N. DUFFY

Gentlemen of the Association: In welcoming you to the fourth annual convention of the Street Railway Accountants' Association of America in this progressive, hospitable Western city, permit me to refer briefly, and with great pride, to the present standing of the association, what it has accomplished, and what it should accomplish.

The association is now on a solid foundation. The membership embraces the representative companies of the United States, Canada and Mexico, in addition to companies representing England and Scotland. Whatever may be the political faith or opinions of the accountants, there can be no doubt that they are thorough "expansionists" on the question of membership in this association. Notwithstanding the fact that the annual dues have this year been increased from $10 to $20, and that numerous consolidations have been effected in the year 1900, I am glad to say that our membership has not been materially affected. The deficit in the treasury, reported at the last convention, has been more than wiped out by

the voluntary subscriptions of the members; we have a substantial cash balance on hand and no unpaid bills or other obligations outstanding.

For the fourth time we are holding our annual convention in the same city, in the same building, at the same time as the American Street Railway Association. We are under many obligations to that association for the hearty support and earnest co-operation it has extended to us, for the privilege of attending its meetings, and for other courtesies that we have enjoyed at its hands. Unquestionably, the attitude of the older association toward this association has brought the operating and accounting departments of street railways in closer touch with each other, to the mutual advantage and benefit of both departments, as well as the good of the companies represented. To the American Street Railway Association we owe much, and I take advantage of this opportunity to express our appreciation of what it has done for us.

The Standard System of Street Railway Accounting of this association, strongly indorsed and unanimously adopted by the Convention of Railroad Commissioners of the United States, is now the standard of that body. All reports to State boards of railroad commissioners (who are members of the national association) for the fiscal year beginning July 1, 1900, will be made in accordance with the standard system, thus placing it in the same position with reference to street railways that the Interstate Commerce classification of accounts occupies with reference to steam railroads.

The department of blanks and forms is now firmly and permanently established and in successful operation. This valuable collection of thousands of blanks and forms, securely bound in books, perfectly arranged and classified, thanks to the genius of our worthy secretary, Mr. Brockway, forms a library of rare and valued books, of which each member is privileged to make use. This feature is of special value and assistance to all members of the association. The exhibit of the blanks and forms at the annual conventions is one of the most interesting and instructive features of our meetings. A valuable addition to our library is the "Railway Officials' Private Report and Reference Book," published by an enterprising supply firm and distributed by it gratuitously. The first copy of this book issued, with the name of the association stamped on the cover, was presented to the association by the publishers. In publishing this book, which is pocket size, admirably arranged and a marvel of the printer's skill, the publishers have recognized the growing importance and value of accounting work in street railways and paid our association a graceful tribute by dedicating the book to it.

In connection with the use of the Standard System of Accounting of this association, we have a strong committee at work, charged with the responsibility of determining a standard unit of comparison. The members who attended the Chicago convention one year ago will remember the valuable paper on this subject presented by Mr. H. C. Mackay, the able and energetic chairman of the committee, and will recall the animated and interesting discussion that followed the reading of the paper. The committee will present another report to this convention; it is hoped you will give the subject the earnest, thoughtful consideration its importance demands, that there will be a thorough discussion, in which every member present will participate, and that we will agree on a standard unit of comparison which will be acceptable from every standpoint and go hand in hand with the Standard System of Accounting.

The advantages of membership in the Accountants' Association, to those engaged in the street railway business, are many and varied. No man could ever hope to accomplish, single-handed, what the association can accomplish as a body. The annual conventions give the members an opportunity of meeting each other, interchanging ideas, learning from each other, and acquiring knowledge and experience which could not be obtained in any other way. The classification of accounts of the association is a self-instructing text-book; the department of blanks and forms is a valuable library of reference. Where, outside of the association, could the street railway worker find such advantages? To those of us who struggled through the disadvantages of an unsystematic accounting system, incident to street railways prior to the advent of modern transportation methods, going through the evolution of horse, cable and electric railways, construction and operation, these advantages appeal strongly. What would we not have given to have had then what we have now? The work of the association, chiefly educational in its character, has only begun.

Having thus referred briefly to the present standing of the association and what it has accomplished, I will now draw your attention to the more important question of what it should accomplish.

Our first and most important duty is to increase the membership. There are some large companies and many small ones not represented on our membership roll which should be with us. An earnest, determined effort should be made, in a systematic way, to see that every company is solicited to join the association, and that they are made acquainted with the advantages and benefits to be derived from being members. This effort should not only be made by the association as a body, but each member individually should take up the work, as a personal canvass is often successful where other measures fail. The life and success of this association depend upon its membership.

I earnestly recommend that this association consider the question of formulating a standard system of accounting and a standard unit of comparison applicable to the lighting and power business. The growing importance of this industry, owing to the introduction of modern electrical machinery, making it possible to generate current at one central power plant, economically transmit and distribute it at long distances, the increased consumption of current for commercial and domestic purposes and the tendency of the present day to combine the railway, lighting and power business, demand that we give this subject immediate attention. There are a number of our membership companies now engaged in the railway, power, electric lighting and gas business. I would suggest that a committee be appointed, charged with the responsibility of this work, and that they be instructed to make their first report to this association at its annual convention in 1901. I would advise that this committee confer and co-operate with a similar committee of the National Electric Light Association, to whom has been delegated the same work for that association. I am pleased to announce that our William F. Ham has been appointed a member of the National Electric Light Association committee. This is a compliment to Mr. Ham, a recognition of the valuable work he has performed for this organization, and an honor to our association of which we may well feel proud.

It would not be amiss to state that the committee on a standard system of accounting, at the suggestion of Mr. Brockway, gave the question of a classification of accounts for lighting and power companies some consideration prior to the annual convention of 1899, but decided not to present it to the 1899 convention, as there were other matters of more direct importance to this association to be considered at that convention. This accounts for our association not taking the initiative.

Accounting is one of the vital elements of business. This is being recognized more and more every day. In reading the proceedings of the conventions of different organizations held during the current year, I was so impressed with this fact that, with your permission, I will present for your consideration some of the more important points which were brought out with reference to accounting, as I feel we should take advantage of every opportunity to study this broad subject in all its phases. At the convention of the New York Street Railway Association, held in Buffalo, Sept. 18-19, 1900, Mr. G. Tracy Rogers, the president of the association, in his annual address said: "Much has been accomplished in the standardization of our accounts, which will work out untold benefit to the roads; besides strengthening our securities, it will give confidence to the public, and afford us material for comparison."

In discussing a paper before the Southwestern Gas, Electric and Street Railway Association, the president of a railway and lighting company said in part: "The point of a comprehensive set of accounts to be kept so that the condition of business can at all times be understood is a great deal more important than we imagine until we go into it, and the more you get into it the more information you will get. We are trying to be able to tell the details of the cost of producing a kw-hour from the time the coal leaves the car until the consumer pays for it. This looks at first as if it was uncalled for, and I have had the question raised that it took too much time. After you have once got into it, it does not take any more time than it did a year ago to make out your monthly report, with a detailed statement, and you can see any little difference as to where your expenses are increasing or decreasing."

In appointing a committee to formulate a uniform system of accounting, the National Electric Light Association recognized the advantages of a uniform system that would be a standard for all to conform to. At the convention of this association, held in Chicago, May, 1900, Mr. J. B. Cahoon presented a paper on "Uniform Accounting." He pointed out the necessity of a system of accounting that would show "true costs," not by single companies, but by a great body, all of whom would follow the same method and use the same system of account in determining the cost of production.

In discussing this paper, Mr. Samuel Insull, president of the Chicago Edison Company, said in substance: "The first step in

this matter is to have our own members, if we can educate them to a uniform system of accounting, state in their accounts what their cost is, and stop them, as far as moral suasion will stop them, from working their construction accounts. If moral suasion will not stop them, if we can get copies of their reports, kept on a uniform system of accounting, we should bring them up here in the convention and ask them to explain their accounts, when some company shows an abnormal profit as the result of immoral accounting."

The question of publicity of accounts of corporations, especially companies engaged in operating public utilities, is receiving close attention. At the twelfth annual convention of railroad commissioners, held in Milwaukee in May, 1900, to which this association was invited and officially represented, the president advocated the enactment of legislation that would compel street railways in all States to make reports to the railroad commissioners, as steam railroads now do. At the convention of the National Electric Light Association the point was brought out in Mr. Cahoon's paper on "Uniform Accounting" that there was no objection to publicity of accounts if "true costs" were shown.

At the last convention of this association it was suggested that we should have not only a standard unit of comparison, in connection with the standard system of accounting, but a standard form of report, full and complete in every particular, a standard system of blanks and forms, and a standard system of accounting methods. I most heartily indorse and approve this proposition in all that it embodies. Now that we have adopted a uniform system of accounts, we should bear in mind one of the fundamental objects of the association, as set forth in Article II. of the constitution, namely, "To improve the work of the accounting department." On the principle that he who does not go forward goes backward, it should be the fixed purpose of this association to broaden and perfect the standard system of accounting in every feature of its practical working application, so that the best results possible from every standpoint may be attained. How shall we do this? The question of a standard unit of comparison has already received careful consideration from the committee to whom it was referred, and they will report to this convention.

As to a standard form of report, I will say that the matter has received attention and will be submitted for your consideration later.

With reference to a standard system of blanks and forms and a standard system of accounting methods, I would recommend that a committee be appointed, charged with the work of preparing model blanks and forms, general in their adaptability and use, with such explanations and instructions as may be necessary or desirable. These blanks and forms should cover the accounting work of every department. I would suggest that the best form for each specific purpose could be selected from the library of the association, and in that way a book of model forms could be prepared. The necessary explanations and instructions concerning the use of forms should include in a general way suggestions as to the methods to be pursued in gathering the figures and data that are to be compiled in each specific form. These suggestions must of necessity be general in their application. Special local conditions will require special study and treatment.

In connection with what this association should do as a body, "to improve the work of the accounting department," each member individually, for himself, for the association, and especially for the company he represents, should take up this work and devote to it all the energy, ability and application that he may have. We should be thoroughly posted on the affairs of the company we are connected with, and have a general knowledge of the operation of the road in all departments, or our sphere of usefulness and the value of our work will necessarily be limited.

We should closely study the special local conditions which are a part of the operation of every road, so that the accounting problem involved may be correctly solved and the conditions of operation clearly and comprehensively set forth.

We should aim to make our system of accounting practical, complete, thorough and economical. The advantages of modern methods in commercial business, and the introduction of labor-saving devices, should be thoroughly investigated and made use of if they can be used to advantage. We cannot be producers of "gross earnings," but we should be increasers of "net earnings." We should be careful not to duplicate work or expend labor that is unnecessary or yields no return. We should not be carried away with a mass of figures and statistics that have no practical value or serve no good purpose, neither should he go to the other extreme of dismissing as useless and valueless much that may be of vital importance, simply because it increases the work of the accounting department or necessitates the expense of additional clerk hire, when results may be produced which would more than repay the work and expense involved. I believe in an accounting system of such scope and extent that the grasp of the affairs of the company, as well as the operation of the property, is at all times within the hands of the accounting officer in charge; a system that will furnish any information that may be required or desired, promptly; a system that will make it possible to answer any question which may be asked.

There are two propositions that enter into the work of the accounting department; though different, they are intimately connected with each other. One is "accounting," the other is "railroading." Mr. H. H. Vreeland, president of the Metropolitan Street Railway Company, of New York, at our last annual convention said this about the calling here represented: "I, from my experience, have always looked upon the auditor or accounting officer of a railway as the most important lieutenant and aid of the president or managing officer of the road. I look upon the man at the head of the accounting department as the confidential accounting adviser of the head of the property."

The papers to be presented to this convention deal with practical accounting questions and are along the lines of the work that this association should now take up. The subjects of the papers were selected and the programme of the convention was arranged with this special purpose in view. To the gentlemen who have responded to the demands of this convention we are under many obligations. I desire to express our most sincere thanks and appreciation for their hearty co-operation.

Special mention is due our able and energetic secretary, Mr. W. B. Brockway, for the valuable work he has performed for this organization. To Mr. Brockway's efforts the association owes much of its success.

To the *Street Railway Review* and the STREET RAILWAY JOURNAL, and our good friends and honorary members, Windsor and Higgins, we are under many obligations for courtesies extended. The columns of the *Review* and JOURNAL have always been open for the publication of anything that would further the interests of this association.

Formal notice has been given, as required by the by-laws, that a change is proposed in Article VII. of the by-laws. This means that the question of changing the time and place of holding our annual conventions is to be voted on at this convention. I earnestly hope that the question will be fully and thoroughly discussed from every standpoint, and that every member present will express his opinion as to what he thinks is best for this association to do, before the matter is put to a vote.

With reference to the next convention, I am reminded of a question of the utmost importance to the association, and one that has given your present officers much concern. I refer to the assignment of papers. The success of our meetings depends in a large measure on the selection of proper subjects for papers and having the papers prepared and presented to the convention. Any member of this association, when asked to prepare a paper, or perform any other duty assigned to him, should appreciate the honor sufficiently and have the interest of the association at heart in such a degree that he would gladly respond when called on and give the association the benefit of his best efforts. This is a duty that every member owes to his fellow-members and the calling he represents, a duty that should not under any circumstances be disregarded or shirked.

In conclusion, permit me to express my appreciation of the honor you have conferred on me, that makes it at once my duty and privilege to preside over the deliberations of the fourth annual convention of this body. To be president of the Accountants' Association is an honor I esteem more than words can express. I thank you for the honor bestowed and for the many acts of kindness and courtesy that I have received from your hands, as well as your valued assistance in many ways. Let me bespeak from you faithful attendance and close attention to the proceedings of the meeting, and especially full discussion on all subjects. I earnestly hope that this convention will be a fruitful source of information and education, as well as a pleasant reunion for us all. Gentlemen, I commit the business of the convention into your hands.

Report of the Secretary and Treasurer of the Street Railway Accountants' Association

BY W. B. BROCKWAY

The report of the work done in this office for a year has become a rather large undertaking, caused by the three divisions into which the office has resolved itself, viz., secretary, treasurer and the department of blanks. In each there has been so much accomplished that it seems better to divide the report so as to cover each section of the work separately. This is without any desire on

my part to imitate the well known Pooh-Bah, but if any such charge should be made, I would promptly lay it upon the happy faculty the association has of being successful and busy, and keeping the secretary busy, too.

In reporting the membership as it is to-day, the prophecy made in last year's report as to the effect of consolidation has been to a large extent verified; but the applications for membership that have been presented have neutralized the loss, so that from a numerical standpoint we are but very little worse off than a year ago.

Applications have been received from the following twenty-one companies:

Indianapolis Street Railway Company, Indianapolis, Ind.
Charleston Consolidated Railway, Gas & Electric Company, Charleston, S. C.
Louisville Railway Company, Louisville, Ky.
St. Joseph & Benton Harbor Electric Railway & Light Company, St. Joseph, Mich.
Union Traction Company of Indiana, Anderson, Ind.
Chicago Consolidated Traction Company, Chicago, Ill.
Manchester Corporation Tramways, Manchester, England.
St. Louis Transit Company, St. Louis, Mo.
Portsmouth, Kittery & York Street Railway Company, Portsmouth, N. H.
San Antonio Street Railway Company, San Antonio, Tex.
Conestoga Traction Company, Columbia, Pa.
Chicago Union Traction Company, Chicago, Ill.
Washington Traction & Electric Company, Washington, D. C.
Winchester Avenue Railroad Company, West Haven, Conn.
Cleveland & Eastern Railroad Company, Cleveland, O.
Connecticut Lighting & Power Company, New York, N. Y.
Consolidated Traction Company, Pittsburgh.
Bridgeport Traction Company, Bridgeport, Conn.
Seattle Electric Company, Seattle, Wash.
Buffalo Railway Company, Buffalo, N. Y.
Erie Transit Company, Erie, Pa.

Resignations have been received from the following twenty-five companies:

Southern Electric Company, St. Louis, Mo.
Nassau Electric Railway Company, Brooklyn, N. Y.
City & Suburban Railway Company, Washington, D. C.
Brooklyn, Queens County & Suburban Railway Company, Brooklyn, N. Y.
Citizens' Railway Company, St. Louis, Mo.
People's Railway Company, St. Louis, Mo.
Lindell Railway Company, St. Louis, Mo.
Missouri Railroad Company, St. Louis, Mo.
Kokomo City Street Railway Company, Kokomo, Ind.
Columbia Railway Company, Washington, D. C.
Hamilton Street Railway Company, Hamilton, Ont.
Columbus Central Railway, Columbus, O.
Metropolitan Railroad, Washington, D. C.
Union Depot Company, St. Louis, Mo.
West Chicago Street Railway Company, Chicago, Ill.
Cicero & Proviso Street Railway Company, Chicago, Ill.
Hawaiian Tramways Company, Honolulu, H. I.
Oakland Transit Company, Oakland, Cal.
Fair Haven & Westville Railway Company, New Haven, Conn.
Milwaukee, Racine & Kenosha Railway Company, Racine, Wis.
Syracuse Rapid Transit Company, Syracuse, N. Y.
North Chicago Street Railway Company, Chicago, Ill.
Brightwood Railroad Company, Washington, D. C.
Central London Railroad Company, London, England.
Lowell, Lawrence & Haverhill Street Railway Company, Lowell, Mass.

The statement of growth in membership is:

Charter members, Cleveland, March, 1897	25
Additions reported at Niagara Falls, October, 1897	12
Additions reported at Boston, September, 1898	32
Additions reported at Chicago, October, 1899	34
Additions reported at Kansas City, October, 1900	21
Total applied	124
Withdrawn	28
Membership Oct. 16, 1900	96

This shows a net loss of but four members. But the average number of applications received per year has been thirty-four, while 1900 shows but twenty-one, a drop of thirteen in the average. These figures show plainly the need of definite action on the part of the present members toward the gathering in of every company within reach. It is not so much that a larger showing may be made that this effort seems necessary as it is to make the association so representative that its deliberations may carry the positiveness which comes from such a larger point of view.

During the year furniture has been added to the equipment of this office, including a second-hand typewriter, a bookcase, a copy-press, etc., costing less than $60.00. All of this was very much needed.

The financial statement is interesting, showing as it does that the increase in dues has been well received by the membership, and that the necessity of a larger income is appreciated.

The receipts have been as follows:

In bank, Oct. 14, 1899	$19.28
Donated account 1899 deficit	160.00
Dues for 1900	1,570.00
Dues for 1899	10.00
Applications	310.00
Interest on deposits	7.65
Total	$2,076.93

The expenses have been as follows:

Salary, secretary	$200.00
Secretary, office expenses	75.90
Postage	62.00
Office furniture	59.25
Printing 1899 Report	260.65
Stenographer, Chicago Report	110.00
Printing	58.05
Department of blanks	12.75
Printing 1899 Standard Report	129.50
Note paid	125.00
Miscellaneous	88.59
Total	$1,181.69
Balance in bank, October, 1900	895.24

Had the dues remained at $10, and expenses for this year as they are—and it is difficult to see how they can be reduced—the result would have been an income of $1,120, and a deficit of $61.69. This income includes $160 contributed at the last convention; without it, the deficit would have been $221.69. To take into account that the expenses are $210.05 less than last year will make the wisdom of the increase in dues more clear.

At this point I wish to explain that, with his customary liberality, President Duffy has refused to receive his expenses to New Orleans to confer with the secretary in March of this year, or to Milwaukee to attend the meeting of the national convention of railroad commissioners. In the latter trip F. E. Smith, auditor of the Chicago Union Traction Company, took the same action; and it is through the kindness of these gentlemen that the treasurer is enabled to report a decrease in operating expenses and so large a balance in bank.

For the department of blanks and forms there is to report a considerable increase in the blanks filed by the addition of the issue of twelve companies and the refiling of a number of reissued forms. All of these add to the interest and value of the collection, which has reached such large proportions though your co-operation.

Among the new blanks received is a large set from the Glasgow Corporation Tramways, which, on account of the differences in practice, were rather difficult to fit to our classification of blanks, and have been filed in a separate book numbered 15. An examination of this set will be found very interesting.

Owing to economy of space, instances will be noticed where blanks have been filed on top of others, in all cases showing the full size and composition of each; but at times, by a similarity of papers, the dividing line could not always be easily distinguished. To remedy this, a light black line has been ruled around every blank, giving a result very noticeable to those who examined the collection at Chicago; and at a glance, rather than by close scrutiny, the blanks are separated and compared.

The new collection of rubber stamp impressions, while not representative, is an interesting addition, and assists to the result aimed at by the department.

Some changes are contemplated in the arrangement of the permanent set and the sets used for requests, all helping in what experience has shown is needed to make the collection a positive benefit, and not let it become merely a curiosity.

It is a pleasure to state that the friendship and help heretofore shown by the officers of the American Street Railway Association and the street railway papers has been continued unwaveringly, and the most cordial thanks are again expressed to them and the many others who have assisted in bringing the association to the position it now occupies.

Address on "What Does the General Manager Want to Know from the Accounting Department?"

BY JOHN I. BEGGS

I must apologize for not having given more time and thought to the subject which you expected to hear discussed by Mr. Wyman. It was only a few days ago, or possibly a week ago, when I was requested by your executive officers to prepare a paper upon this subject. I have never prepared a paper in my life, and am almost too old to learn new tricks. Therefore what I shall say upon this subject will be simply the thoughts that are suggested to me as the manager of one of these public utilities.

What the general manager wishes to know from the accounting department, I should narrow and say, "What does the general manager wish to know from the head of the accounting department?" I would not be presumptuous enough to think that I, in the few minutes that I shall occupy, could stand here and tell to you what the general manager wants to know from the accounting department, when so much time has been so well expended by your association for several years past developing and demonstrating just what he should know. The system of blank forms and accounts that you have developed is highly creditable to your association. It will do much to save the industry in which we all are so vitally interested. The first thing the general manager wants to know from the accounting department, in my judgment, is that the accounting department believes in the general manager's policy. He wants to know that he has loyal, enthusiastic, energetic supporters in carrying out what may be the general manager's policy, and that they will aid it conscientiously and fearlessly; and when the head of the accounting department cannot subscribe to the general manager's policy he had better tender his resignation. As a rule the general manager stands for the board of directors, and they are supposed to stand for the stockholders, which is the capital. Unfortunately, they have not always done it, but they should do it, and I think that the executive managements of these public utilities are year by year giving a stricter account to the great body of stockholders. In order to do this we must have conscientious, earnest work both on the part of the general manager and of the accounting department. Unfortunately, the general manager is not always a trained accountant; he is too often not competent to analyze and determine whether or not the accounts and the various statements that come to him are made up intelligently, or to analyze and determine whether or not they have been properly kept. And that, in days gone by, has been responsible for the failure of some of these public utilities, and caused them to be re-financed. They have run aground without knowing it; like the mariner whose compass has become disarranged or does not know how to read it, they are cast ashore; they run against the breakers, and it is the easiest thing in the world, because too often it is to the interest of the general manager and the board of directors to make too glowing a statement of what they are doing, and this is particularly the case during the years of construction or development when they have a capital account to be drawn upon.

Capital account has covered multitudes of managerial blunders and extravagances. Therefore I always take the position that it is best to close up the construction account as quickly as possible. If there is going to be any error made in your accounting departments, gentlemen, let it be on the other side. Have a little more property than you think you have. When a man puts his hand in his pocket and expects to find seventy-five cents, but finds instead a dollar, he feels very good. It is not a very large amount, but nevertheless it is on the right side. He has just a little more than he expected. But if he puts his hand in his pocket and finds he has only fifty cents, he is disappointed; he says, "I certainly thought I had more than that," and such is the case with many of these properties, that they go on deluding themselves; because there is a construction account, they charge into that many things that should have gone into operation. It is one of the reasons why many new enterprises seem to show such phenomenal results. I have seen a statement very recently of a certain line running into the city of Chicago, or nearly so, showing the expenses to be down to somewhere about 30 per cent. Now, we all know how that is produced. Of course, that is not done in order to show what the actual results are. It is produced in order to unload a promoter's property upon an unsuspecting investing public. I only refer to that because that statement has been brought to my attention within a few weeks, being on the market. But very often our properties get into the same condition, because of a lack of intelligence. Therefore the general manager wishes to know from the head of his accounting department—and I shall deal with the head—that there is an intelligent understanding and an honest practice in the making up of either the daily, the monthly or the annual statements.

As I said at the outset, the general manager wishes to know that the head of the accounting department is in sympathy with and believes in his policy, because a general manager should lay down the policy for his corporation. He is put there for that purpose. Now he must know that his associate who is in charge of the figures believes in that general policy, will help him carry it out, will in every manner co-operate with him, will watch and see that there is consistency throughout every department of the company's business.

Some of our properties are in a little more complex condition than others. Take the property with which I am associated; we conduct a very large electric lighting business in three or four different cities, some part of it under our main company, some under a traction company which we operate. Consequently, it is very difficult at times to feel that the same general practice is observed in each one of the co-ordinate companies, possibly under the name of one, and that the head of each particular department observes the same methods as are observed in every other.

In the street railway business it is highly important that the general manager shall have confidence in the integrity, in the vigilance and discrimination and keen perception of the head of the accounting department, and know that he will watch that there is no injustice permitted even to the humblest employee of the company, and that the trainmen are held to strict account. The idea should not get abroad among your force of conductors that there are too many shortages being reported, or that there is too much carelessness in the accounting department. We make it a rule to have the accounting of the trip sheets and the returns of the various conductors directly under the head of our accounting department. We have but one head of "figure wrestlers," as I call them. We do not have it divided into transportation department, and so on, but all is under one head. I am a great believer in centralizing responsibility, and in having one head responsible, and giving him the highest degree of confidence. One of the most important things in dealing with the conductors on street railways is that they have absolute confidence in those who pass upon their daily returns. They should not, every day or two, be brought face to face with the charge, "You have a shortage to-day of a dollar," or fifty cents, whatever it may be; that creates distrust, and it soon permeates the whole mass of men. They begin to distrust the accounting departments, and to believe that their methods are not accurate. That comes back; it works almost incalculable harm among our men, and we who are managing these properties to-day are carefully studying that there shall be no cause of unrest, of dissatisfaction, among our trainmen. You have seen a number of serious labor troubles among that class of men during the past year. We went through it, four and one-half years ago, one of the first large railway strikes. We have watched it carefully ever since. It very often comes from the accumulation of a multitude of these trivial matters, that give good cause at times for unrest.

These are some of the things we want from the head of the accounting department. I am ignoring your system of blanks entirely. I did not conceive that was what you wanted to hear about, or that it would be a thing of particular value to you, because you are giving labor and conscientious thought to that subject. The blanks are being perfected from year to year, and developing in greater detail. I thoroughly understand that in different corporations there are varying conditions that do not apply to all. Consequently there must be, with your system of accounts, provisions for some flexibility that may suit the peculiar conditions of various corporations, many of which are interested in a variety of things, and have more than one interest to provide for. They must likewise be sufficiently flexible to permit sometimes of what may be the peculiar or unreasonable notions of the general manager. He may have an idea that he wants injected into them certain additional features, or possibly a very good reason from his standpoint, which is not always recognized, perhaps, by the head of the accounting department. The general manager should have the confidence and command the respect of the head of the accounting department to such an extent that notwithstanding it may cause some additional labor to provide these auxiliary accounts, as we might call them, for his information, the work will be cheerfully done. The manager may have better reason for asking for them than appears on the surface, and it may entail, as the head of our own accounting department has sometimes found, a considerable amount of additional labor; but it is not useless; it is for some good cause. I am well aware that all managers have ideas that are different possibly from those of the heads of their accounting departments because of some previous experience they themselves had in the science of accounting. I use the word "science" advisedly, because accounting is a science, and if the broad, fundamental, underlying science of accounting is thor-

oughly understood by the head of the accounting department, it will be much easier for those charged with the operating of the properties.

I had something to say when this association was being organized as to what should be included, having given considerable attention to the various forms of accounting of this and its kindred industry, electric lighting, for a great many years. In fact, I was one of a committee some fifteen years ago to standardize a system of accounting for electric lighting plants in that early day. They had done more, I think, in the line of standardizing their accounts, or at least one branch, electric lighting. I speak more particularly of the old Edison Association of Illumination Companies, which was a close corporation and still is, I believe, but I was the president of it for seven or eight years, and we had a very carefully devised system of accounting whereby we could, with a great degree of accuracy, compare the results of various companies throughout the United States. Though more limited than this association, we demonstrated, at that early day in the electric lighting industry, the great advantage of being able to compare accounts. That is highly advantageous, absolutely essential even, in the street railway business. The general manager wants to be assured that the head of his accounting department is watching his expenditures from day to day, watching that the estimates made of construction, or of some piece of reconstruction, do not seriously exceed the requirements, or if they do, that the fact will be brought to the attention of the general manager in order that a proper remedy may be applied; that the practice throughout the various departments of the corporation is uniform, so he may not have, as is sometimes the case, an employee in one department asking to be transferred to some other department in the business of the same corporation for the reason that the practice is different. Such a condition should not exist, and yet it may exist if the comptroller, or the auditor, or the head of the accounting department, by whatever name he may be known officially, does not bring to the attention of the executive head the facts that exist. Take it in our own corporations, where at times our employees number anywhere from two to three thousand men; it is impossible for the general manager to attempt to know what every specific rate of pay is throughout all departments, and that there is uniformity in the pay-rolls and uniformity in the hours put in in the various departments. All these things come directly under the eye of the head of the accounting department, and where irregularities exist it is highly important that he should report them in order that a remedy may be applied.

It is furthermore important that he keep the general manager advised as to how the receipts are on the various lines. While some general managers try to follow those things, they do not all do so. They would not all be competent, because of a lack of early training in the science of accounting, of determining whether the matter was accurately compiled and put in shape. The manager should see that the various lines are being operated with the smallest number of cars in order to produce given results. If on one line a car is earning two dollars per car-hour—you notice, gentlemen, that I said "car-hour"—and on some other line a car is earning only one dollar per car-hour, and that going along month after month, there is some reason for it. It may be a good one, but nevertheless it is the duty of the accounting department to bring the matter to the attention of the general manager. The accountant may be conversant with the reasons why certain things are so, but as these matters are coming under his eye day after day, if discrepancies exist he should promptly bring them to the attention of the general manager.

The general manager desires, furthermore, to know that the head of the accounting department is taking occasion to correspond with other roads of similar size operated under practically the same conditions, in obtaining copies of their reports, comparing them and bringing to the attention of the general manager features in them which would seem to show that as regards certain features the other lines were being operated more economically than his own. The points wherein we are operating better than the others I do not care to know about. I arrange to have the heads of departments go away two or three times a year to some other city where perhaps there is a very good system of operation and management and a good system of accounting; I am very glad indeed to have the head of my accounting department take two or three short trips during the year, to go to different cities, and observe their methods, and I always say: "I don't want you to come back and tell me a single thing that we are doing better than they are. I don't want to know that. That will take care of itself. But go and find something that they are doing better than we are, and we will try to copy that, and, if possible, improve on it just a little." The managers want to know, and they do not always have the time to investigate for themselves, that this comparison of accounts is made; otherwise, what is the use of this uniformity, if you are going to close it up or lock it up in a safe? I want any company, the head of any accounting department, allied to this association, or to the Street Railway Association, to feel that it can send to the Milwaukee Electric Railway & Light Company, or any other company in which I am in an influential position, and obtain any data that we have. We do not consider it a burden to give information to you; if we have to put on a clerk to copy the reports, we will do it. I want, likewise, to feel that if we wish to have some information from any member of this association, or of the Street Railway Association, that they will not feel that we are burdening them when we ask for it. In our practical operation I many times take time that I could not command for myself, but I do take it, to go over our system and show its various phases to gentlemen who come from a distance to see what we are doing, and I take pleasure in doing it. The exchange of ideas is valuable, and unless these various statements, these various reports and results that are being realized by the various companies are going to be interchangeable, of what use is this uniformity of accounts? It is for some purpose. It is for the purpose of being able to make fair, intelligent comparisons, that we may know what we are doing. Above all, have the head of your accounting department keep his accounts in such a way that you do not need to fear if at any time your State railroad commissioner, or if perchance there should be a national railroad commission, should order your books closed. Let your accounts be upon the same basis as is adopted by the national banking department at Washington; when an order is given for a statement of accounts, it is not of some day in the future, but always some time in the past, so that there is no opportunity to fix up the books. So our accounts should be. We want particularly to know, or at least I want to know, that if the head of our accounting department and all of his assistants are called hence, that a new set of accountants can go to their desks in the morning and find nothing to clean up for yesterday—that the work is kept up day by day. That is highly essential, and if that were always done, it would not take so long for many managers to get a statement of what their actual condition is. It is highly important to know that there is promptitude with all these accounts, that the work is always right up to date. It will save many errors and blunders. It is one of the besetting shortcomings of many accounting departments that they are always going to do something, going to prepare some statement some time in the future. The future is not theirs. Consequently it is highly important that accounts shall be always up; that if the general manager wants to know something he can send with assurance to the head of the accounting department for such and such a statement and it will be forthcoming as soon as it can be transcribed from the books, or from some other statement, or that he can send the original. Two of the most important things that a general manager wants from the accounting department are accuracy and promptitude.

As I said at the outset, I have to apologize for not having prepared an address such as would no doubt have been prepared by my friend, C. D. Wyman. I am substituting for him this morning. I have been substituting for him for four years. I desire, on behalf of the managers of street railways, to extend to this association my earnest, heartfelt appreciation of the good work your association has done, still is doing, and which I hope it will continue to do. I think no higher compliment could be paid to your association than the co-operation asked for by the steam roads and by other organizations of this kind in their efforts to perfect a standard system of accounts and of forms. This matter of standardizing the forms on which the accounts pass from the various heads of departments into the accounting department is as important as the standardization of accounts. Much of the accuracy of the accounting department will depend upon the comprehensiveness of the forms that go out from the storerooms, from the heads of the various departments, from the man in the shop, as showing the cost of a certain piece of work, and so on down the line. There is quite as much necessity for making these various blanks uniform throughout as there is for the accounts themselves, because if these various blanks are not fairly uniform it will be much more difficult to make uniform the accounts based upon them. I do not know just what forms the association has adopted. I think in our own practice we subdivide to a somewhat greater extent than is provided for in the standard forms of your association. However, we keep the various heads so thoroughly in accord with the standard system of accounts of this association that they are practically the same, with the exception that I subdivide to a greater extent some of the expenses of maintaining equipment. I have the cost of all labor and all material subdivided.

I can keep the cost of material in my mind. When I see a statement that material costs so much, I can check whether or not

that is about right, without asking any additional figures; but they can cover up a multitude of sins, omissions and mistakes in the item of labor. In all work, my suggestion would be that you subdivide and differentiate between the cost of labor entering into any piece of work and the cost of the material entering into it, because the general manager, if he is familiar with his business, knows about the amount of material. If it is putting a set of wheels under a car, I know what those wheels cost. I do not know if the thing comes to me bulked, called wheels and labor; I cannot tell whether the labor has cost $1.50, which would be about the cost of putting on a pair of wheels, or whether it is $2.50 or $3, if it is all covered up in one item. Therefore I urge upon the Accountants' Association the advisability of subdividing the cost of materials as against the cost of labor that is necessary to put that material into use. We subdivide in our own practice. For car bodies, for instance, we keep carefully the cost of painting, etc., as an item by itself. Likewise, the cost of heating, the cost of lighting cars. Many of these things that are coming to him in that way the general manager wants to know, in order that he may be able the better to analyze and determine whether these various items are being kept down to the lowest point consistent with the highest degree of perfection in the maintenance of his construction.

Above all, urge upon your municipality and legislative bodies that they shall call for the publication of your accounts. I for one believe you owe it to them. You are simply trustees for certain rights which they give you in the municipalities. You will quiet much of the criticism we hear regarding public utilities when you make public your accounts. We have had a pretty lively time in the city of Milwaukee for several years, as some of you no doubt know. We have finally got them harmonized to a certain extent by having had passed by our municipal legislature, or Common Council, so called, last winter, an extension of our franchise and the straightening out of certain questions in connection with it, up to Dec. 31, 1935. We are here to-day with a decision from the Supreme Court of Wisconsin, handed down on Friday last, affirming that franchise and quieting all these various questions. It was claimed that we were suppressing our accounts, that our profits were much greater than they ever were, and the Municipal League and other associations went before the Legislature some eighteen months ago, at the biennial session, last winter a year ago, to present a bill requiring us to file our accounts and annual statement with the officers of the State. They expected that we would antagonize and oppose them, and possibly by underhand means defeat it; instead of this I urged the passage of that act. Our accounts should be kept, as I said before, in such a manner that you do not fear the closest possible scrutiny, either as to the underlying policy of the corporation or as to the methods employed in working them out. Once be honest and you will quiet much of the criticism in the various localities in which you are operating. Under the law of Wisconsin to-day, every street railway and electric lighting company must file a statement giving in great detail the results of its operation every year, and we have no hesitation in doing so. We believe that it will do much to bring about a better state of feeling beween the general public and the corporation that is serving it. I believe in the broad, general underlying principle that a street railway company is, of all corporations, one in which the general public is most vitally interested, and it has a right to be informed as to your methods of operation and of management. We are public servants, and we are the one class of public servants with whom everyone in the community must come in contact. He may escape everything else, he may escape the tax-gatherer, except once a year, the undertaker, except once in a lifetime, but the street railway company he is coming intimately in contact with several times a day. In our own city we are carrying at the present time an average of one-half of the entire population every twenty-four hours. They are vitally interested, gentlemen. Do not attempt to deny it, but proceed upon the broad, general principle that they have a right to know that the property is being conscientiously operated so as to afford them the greatest possible degree of convenience, of comfort, of safety and of reliability, and to this end the heads of our accounting departments can do much to assist the general manager and relieve him of many of the details of the complex position in which he is placed.

I thank you, gentleman, for your patience; I thank you for the courtesy of calling upon me to fill the gap left in your programme. I only regret that time has not permitted me to have given to the subject more analytical thought, that I might have presented these views in possibly briefer form, and possibly in form that would have produced what I wish to produce, the making of your organization more valuable, if that is possible, to the great interests that we represent.

Report of Committee on Standard System of Accounting

BY C. N. DUFFY, CHAIRMAN

No changes in the present classification of accounts or in the forms of monthly and annual reports suggest themselves to the committee; none have been suggested, therefore we recommend that the classification stand as it was adopted at the Chicago convention in 1899, unless this convention directs otherwise.

Your committee received very few queries from members regarding the classification of accounts. These queries were promptly answered. It is assumed that the classification as it stands, in the absence of any information to the contrary, is satisfactory to all. Your committee would be pleased to hear from the members regarding this question.

With reference to the classification of material and supplies, submitted by this committee to the 1899 convention, in a supplementary report, no official action was taken by the association. Your committee, in referring to this matter now, desires to explain that the classification submitted was not intended for anything more than a suggestion to the convention that would possibly aid in dealing with the important subject of material and supply accounts.

The Standard System of Accounting is now in general use, recognized and accepted as the standard for street railways. One of the most valuable features of the system is that it admits of comparisons between companies. This feature is especially appreciated.

At the convention of the National Electric Light Association, held in Chicago, May, 1900, a paper on "Uniform Accounting" was presented. This paper criticised the Accountants' Association for treating taxes as a deduction from income, stating taxes should be considered a part of operating expenses. This position was indorsed in the discussion of the paper, following its reading. Stuyvesant Fish, president of the Illinois Central Railroad Company, in an article published in the *Street Railway Review*, was quoted as saying that the inter-state commerce classification of accounts did the railroads an injustice and caused them to make misleading reports, because taxes were not treated as a part of operating expenses. All of this is very interesting in view of the action taken by this association on the question of the classification of taxes. Your committee does not care to provoke any further discussion regarding this matter, but begs leave to refer to its position as it explained and sustained it and was sustained by this association at the conventions in 1897, 1898 and 1899. The paper presented to the National Electric Light Association not only classified "taxes" as an operating expense, but "interest on investment," "interest on current liabilities," "investment insurance" (depreciation), and "reserve for sinking fund." These five accounts are all classified as operating expenses, grouped under the heading of "capital accounts." The reason for doing this was, that it was held these accounts should all be included as a part of operating expenses and not as deductions from income, in order that the "true cost" of production could be determined. Your committee does not wish to do anything more than present this matter for your information and consideration, without comment, further than to refer to the grouping of these five accounts under a heading entitled, "capital accounts." The gentleman who presented the paper frankly stated that his stand was open to criticism; for that reason, and because your committee believes that this association should not criticise the position taken by other associations on questions of accounting, it is desired that the matter should not be discussed by this convention.

This association was invited to attend the convention of railroad commissioners of the United States, held in Milwaukee, May, 1900. H. C. Mackay, F. E. Smith and the chairman of this committee attended the convention, responding to the roll-call when our association was called. We were officially recorded in the minutes of the meeting as having been present and representing this association. Nothing transpired at the convention of any direct importance or interest to this organization, except that Ashley W. Cole, chairman of the board of railroad commissioners of the State of New York, a member of the committee on classification of construction and operating expenses of electric railways, reported for the committee that the 1899 convention adopted the committee's report (this report was the classification of accounts adopted by the Accountants' Association.) Mr. Cole stated that some of the States recommended that report to the corporations within their jurisdiction, and the State of New York has had that report printed in pamphlet form and is now sending it to all the electric railway corporations in the State.

Your committee has made a strong effort to induce the Federal Census Bureau to use the Standard System of Accounting of this

association in the work of compiling statistics concerning street railways, in connection with the census report of 1900. We hope to succeed in this undertaking, and feel encouraged from the following statement of the director of the census, made in a letter dated July 24, 1900: "The subject of street railways is a special one, which will not be taken up for about a year. I will have the letters placed so that they will have full consideration when the proper time comes. I am glad to receive suggestions at any time."

The Routine of a Railway, Electric and Gas Lighting Company

BY C. O. SIMPSON

In this paper upon the routine of a railway, electric and gas light company, no attempt has been made to go outside of our own office, but I will touch briefly on some points which have come under my observation in the past ten years, or while in the street railway line. I do not, however, confine myself to the street railway business alone, as there are a great many companies like the one with which I am associated that have the electric light as well as the gas business of the cities in which they are located.

First the railway, starting with the report from the conductor to the accounting department. The office furnishes the train dispatcher the night before with the "portable" registers, and a list showing number of same, and the register readings. The dispatcher gives out registers only to the daylight and six-hour men, as they start out in the morning. All other registers are given out at the office. This list (Form 1) is returned to the office by the dispatcher, not later than 9 a. m., with the name of conductor filled in and certified to by him. This goes to the young man in charge of the car earnings record (Form 2); also the trip sheets (Form 3) and envelopes (Form 4) containing the conductors' remittances after they pass through the cashier's hands. The cash is handled by only one person and goes directly from the conductor to him and from there to bank, which furnishes a duplicate deposit slip which is turned over to the chief clerk for entry on general cash book, after a comparison with the earnings record.

All money, when ready for bank, is put in such shape that it will be accepted by the teller without counting bills or wrapped silver at time of deposit. Currency is put up in $50, $100 and $250 packages; on wrapper is marked company's name, date and amount. Silver is also wrapped and marked accordingly; small change to make up balance of deposit is put in envelope.

Cash tickets are checked up with earning book by auditor every month and burned. Transfers are counted, and after comparing with trip sheet are destroyed.

Conductors' reports are filed daily; that is, each day is fastened together and kept in a convenient place in office until end of month; they are then filed in store room.

A small ledger with index is kept of over and short account. An account is opened with each conductor; the Dr. side is short, and the Cr. side is over. This book is kept where conductors can see it every day, and if they find a shortage they make their remittance that much more, or vice versa, to balance the account, as shown by said ledger.

The cashier also handles all collections of the electric light and gas departments, keeping a separate petty cash book for each, giving as much detail as possible to the bookkeepers in charge of the different department ledgers, and general cash book (Form 5) into which it is condensed, as the ledger is ruled, so that only the amounts are necessary, except in the sundry column.

The electric light register (Form 6) is used entirely as a load book; that is, it shows the number of each candle-power light, motor power, fans, and if on meter, meter readings in kilowatt-hours. The reading of electric meters are recorded on cards (Form 7). These cards are turned over to bookkeeper on the completion of each route for entry on register.

Bills (Form 8) are made from the register and are then carried to the light ledger; each account is numbered, having the same number in both books. The light ledger (Form 9) shows the balance forward each month, if any; amount of bill for the month; total column, rebate, amount paid and date of payment. These books are made to run six months; with the addition of a short leaf they can be made to run twelve months, but, owing to the accumulation of dead accounts and new business, this is hardly satisfactory.

The light ledger contains forty-two accounts or lines to a page, and the register only fourteen, which equals three pages to the ledger, making it easier to balance and check as you go along. The cash column in the ledger is balanced with the general cash book. With this form of ledger it is not necessary to keep a collection list, as the accounts are compact enough if posted regularly every day, from which the collector makes his delinquent list. We use the card system in connection with the changes; that is, one side of the card is used as an order to the electrician (Form 10); the other side (Form 11) shows the work done on the order, and from this entry is made on the light register. At the end of each month a recapitulation is made of the changes to show the loss or gain in any part of the service.

The names of customers are kept in both register and ledger, alphabetically and in the order of the vowels. When transfer is made to new books at the end of six months, we do not give a numbered place in the ledger to accounts that show balance only, but on one of the back pages of the ledger we keep these delinquent accounts under the heading of "balances," the total being carried under the same heading and given a number in the front of ledger, until finally paid or written off. Advance customers are treated in a similar manner, except that they are given a number preceded by the letter "A." I also wish to add that all churches and Chinamen are put together under letter "C," but are given a regular number.

The gas books are similar to the electric light books, except the register or load book, which only shows the meter reading—past, present and consumption for both lighting and fuel at the different prices per thousand feet. The gas bill is almost a copy of the register book, but, in addition, is ruled to show discount for prompt payment before the 10th of the month, following consumption. The reading of gas meters are recorded in a book printed and ruled for that purpose. The routes are divided into what we call the uptown and downtown routes, and are read by two men, who alternate every other month. The bookkeeper takes these readings direct to the register or load book. The recapitulation of the register or load book compared with the register of output at plant will show the leakage.

We use the "addressograph" in connection with both electric light and gas bills. This machine prints the number, name, address and date of bill in one-tenth the time it formerly took our bookkeepers to do the same work.

We use a bill register (Form 12) in which is recorded all bills due the company for material sold or labor performed. One line is used for each bill, and the book is ruled as follows: Date of bill, number of bill, against whom item, date rendered, amount, date paid, account credited and remarks. Each bill is numbered.

All bills and accounts against the company are paid by voucher (Form 13), which gives all the details. There is provision made for inserting a description of each bill, and in addition to the description on each voucher, the original approved bill is attached, but the latter never leaves the office. If the voucher is paid through the mail, all bills are attched to a slip, the same size as that of a folded voucher, called a "tracer" (Form 14), and remains there until voucher is returned and receipted; all papers are then attached to voucher and filed away.

Vouchers are numbered consecutively, commencing with number one each month. The voucher record (Form 15) is ruled to show first voucher number, month, in whose favor, amount pay roll or voucher, account charged, store stock, operating expenses, sundries account, etc. The recording of a voucher will occupy as many lines as there are accounts to be charged in the distribution, and are charged on the record direct to the operating, construction or other accounts affected. No bill for sundries or material, etc., is vouchered until approved by the purchasing agent and superintendent. It is then made up by the chief clerk, and goes to the auditor and president for their approval before recording or payment. The pay-roll voucher (Form 16) is made up from reports of time (Form 17) from the heads of departments. The distribution is made, and it is entered in the record and filed as a regular voucher.

Unclaimed wages—that is, wages uncalled for after six months—are credited back to the account as charged on pay roll, and record made on pay roll accordingly.

General journal entries are made from a manuscript statement, which is a recapitulation of the several books, such as cash, bills and vouchers, and these statements become a part of the permanent file; therefore it is not entered in detail in the journal. The traffic statement (Form 17) is made from the car earnings book, and gives all data necessary to make up statistics as to the traffic on the road for the month, but only that portion pertaining to the revenue and how earned is journalized. A recapitulation is also made of the bill book, and the entry made charging bills for collection with the total amount of bills and crediting the different accounts, as shown. The recapitulation of the voucher record is made in a little more detail. The operating accounts of the railway and electric light departments are separated, as well as the construction and sundry accounts, and gives the voucher

number and amount of each voucher charged to that particular account. The entry is then made charging each operation, construction and sundry account with the total for the month, and crediting vouchers and pay rolls their respective amounts. The recapitulations of the cash book and light ledger is similar to the others, but more attention is given to the cash book, as it embraces the particulars of receipts and disbursements, and clearness in entering transactions is of great importance even in the general cash book.

There are a number of what we call "regular journal entries," such as the transportation of letter carriers. An entry is made charging the United States Post Office Department (which is an open account on the ledger) and crediting the earnings account with one-twelfth of our yearly contract, and when the quarterly payment is made by the Post Office Department it is credited direct to this account on the cash book. Similar entries are made for the rent of power for the operation of a short line running from Augusta over the Savannah River into South Carolina, which we do not control. Chartered cars are usually paid for in advance, or the day following their use, and are credited direct to the account through the cash book; if not, they are billed and so pass through the bill register. Interest on the bonded indebtedness is charged to "interest on bonds," and crediting "accrued interest on bonds." Semi-annually an entry is made charging the latter account with the semi-annual interest, and crediting interest-coupon account. When remittances are made for this interest to our Eastern representatives, it is charged to their open account, and it so stands on the ledger until the coupons are returned to the company, as they are very seldom all paid and returned at one time, or within thirty or sixty days after due. The journal entry then made, or made from time to time as they are returned, is necessarily in detail, giving the series and numbers of each, charging to interest-coupon account and crediting our Eastern representatives.

We have also an account called "advanced expenses," into which we charge direct from voucher when payment is made for such items as taxes, coal, water for power, etc., which are paid quarterly and annually; or extraordinary heavy purchases of material. An entry is made each month to the respective operating accounts, charging out approximately what would be, or has been used in that month.

The balance of many accounts, as shown by the balance sheet the first of each month, for instance the amount in the debit column to gross electric light and power account, will be the same as the total of the balance sheet of the light ledger which comprises something like 1500 individual accounts. The balance of bills for collection consists of the unpaid bills, as shown by the bill register; the balance to vouchers shows those unpaid at that time; also the pay-roll account.

We use the ordinary check book, as everything is paid by vouchers, the stub of which shows the name and number of vouchers covered by corresponding check, which is all that is necessary for entry in the cash book. Separate check books are used, one for the railway and electric company, and the other for the gas light company, as they are at present separate corporations, but are handled as one as much as possible, to reduce expenses.

Monthly statements include the railway and electric lighting department on one statement, but the earnings and operating accounts of each are shown separate. The gas light company's statements are made separate, but the form and accounts correspond with those of the railway and electric company as much as possible.

The most valuable of all papers, I consider the real estate, deeds and plates representing all the realty of the company, whether used in the operation of the road or not. A separate book is used (size, 10 ins. x 14 ins.), called real estate book, on the left-hand page of which is a plat of the ground, and on the right hand, or as many pages following as is necessary, is a description of same. The index to this book is complete, indexing, perhaps, under six or seven headings, as the property is referred to a great many time, as the tract of some of its former owners or by the company as the "Power House property," "Sand Pit," "East Station," or "West Station." The deeds are kept in a bankers' file and given the same number as per folio in book.

Contracts are also filed in an ordinary bankers' file.

Ordinances are usually published in the daily papers, a copy of which is pasted in a scrap book; if not printed, a written copy takes its place.

Letters are filed in the ordinary files, but, in addition to copying, the stenographer makes a carbon copy of the answer, which is attached to the letter before filing.

The stock ledger and the transferring of stock is very simple. The ledger is ruled, first giving the top of the page space for the name, address and any other information as to the payment of dividends, etc. The balance of the ruling shows first date, transferred from, or to; certificate number, Dr. shares, Cr. shares, Cr. balance. All stock certificates when canceled have written across the face to whom issued and number of new certificate. This certificate is then attached to the stub bearing the corresponding number.

As is well understood in this association, a frank discussion is invited of the methods and forms I have explained. Any system adopted by a company is more or less a growth evolved from emergencies and circumstances, and side-lights thrown by opinions from different points of view are always valuable.

Report of Committee on a Standard Unit of Comparison

H. C. Mackay, Chairman, F. E. Smith and A. H. Ford, Committee

At the last annual convention of this association, the Unit of Comparison, as treated in the paper presented by H. C. Mackay, was referred to this committee to report at this convention, action having been deferred for the lack of sufficient time to discuss the matter properly and to admit of further unbiased investigation.

It is a matter that, since the adoption of electricity as a motive power, had received very little serious thought; and the discarding of a unit that had for years been recognized as the standard, naturally brought up questions requiring more study and investigation than could then be given them. It is but fair to say that this committee's opinion was divided as to the merits of the different units advocated, but, after studying the matter in all its bearings, we are convinced that the motor car-hour is the best unit yet advocated; and, being the same on all systems, large or small, it cannot be otherwise than practicable. Since that time, it has been put to practical tests, having been adopted by some of the largest systems; viz., Minneapolis and St. Paul, Minn., and Milwaukee, Wis. This test has demonstrated that the motor car-hour is a stable and correct unit, and it has further conclusively shown that the car-mile is an unreliable unit, even between lines of the same system. To illustrate, we submit the following figures taken from actual service and applied here to comparison of earnings:

	Speed	Earnings	
Line.	per hour	Per car-mile	Motor car-hour
No. 1	8.3	33.25 cents	$2.76
No. 2	16.2	28.57 cents	4.63
No. 3	10.7	26.79 cents	2.86

The supposition was (up to the time of comparison on the basis of motor car-hours) that line No. 1 was proportionately the best earning line of the three, but the truth is, it is the poorest. This erroneous result was made to appear true on the basis of car-miles, simply because this line was operated at a lower rate of speed, the smaller divisor naturally leaving a greater quotient:

As applied to operating expenses, we submit other figures:

Car mileage	3,653.00
Motor car-hours	350.00
Earnings per day	$1,367.50
Operating expenses per day (50 per cent)	683.75
Earnings per car-mile	.3743
Earnings per motor car-hour	3.91
Operating expenses per car-mile	.1871
Operating expenses per motor car-hour	1.955

Reducing the speed of this line 25 per cent, retaining the same equipment and running the same length of day, what is the result? We have, without changing the cost of operation, reduced the mileage made from 3653 to 2740.

The expense per car-mile was $.1871, and is now $.2495, an apparent increase of $.0624.

The expense per motor car-hour was $1.955, and is now $1.955, showing no change, as none exists.

Speed, then, is shown to be the factor that prevents the car-mile from being used as a correct basis. Speed does not enter into the motor car-hour. The absence of this variable quantity of speed, together with the fact that labor, the principal item of expense, is computed on the basis of the hour, or multiple of the hour, sustains our position.

It is interesting to note the conclusions of the steam railroads regarding the use of the car-mile as a unit. The following figures were taken from the report of the thirty-third annual convention of the American Railway Master Mechanics' Association. The committee emphasized the unreliability of the car-mile by the following comparisons, showing the cost of operating a simple or ordinary engine to be $.2449 per car-mile, and the cost of a compound engine to be $.2883 per car-mile, an apparent difference of 17 per cent in favor of the simple or ordinary type of engine. Yet, by reason of the greater capacity of the compound engine, the

cost per 10,000 ton-miles was $3.23, as compared with $4.03 for the ordinary engine, thus showing an actual gain of 24 per cent in the work performed in favor of the compound.

For special comparisons, it is recognized that special units are required, as for example, the output of a power station would be based on the kw-hour, this being more closely relative to the work, but for all general comparisons of earnings or operating, the motor car-hour is advocated.

As to the question whether a standard unit is practicable or not, it would seem that, given a unit of comparison, which is admitted to be identical in every case, the question is not debatable. If the unit is correct, the result or comparison must be correct, as the component parts of all accounts have already been standardized by this association. It has been claimed that the variation in cost of operating, between a high and low-speed line, affects the value of the motor car-hour as a unit. The high-speed line certainly requires more current, and its repairs to electrical equipment are greater, but we are at a loss to understand how this can affect the unit. We could as consistently question the value of the yard as a unit of measurement because one kind of cloth cost 10 cents and another kind 12 cents per yard.

If a manager was shown that the cost of maintenance of electrical equipment of cars was 25 per cent more on his system than on another, it would certainly be to his interest to investigate, to determine whether more improved motors were being used, or if greater care was not being taken in the use of them. Very true, the investigation might develop that the difference in cost was due wholly to greater grades or to excess of travel on his lines, but it would show him the facts, and wherever a difference did exist, would advise him of it. This would be a practical use of a standard unit.

It was contended that the cost of ascertaining the number of motor car-hours would be such as to preclude its use on a large system. As a matter of fact, it is so much more easily determined than is car-mileage, that the cost is naturally less, and the readiness with which it is ascertained is one of the strong arguments in favor of its adoption. Especially is this the case in cities where large numbers of cars are run without reference to schedule time, but wherever and whenever deemed necessary. Experience has shown that reports of mileage made by trainmen are only approximately correct, but the record of the time of the starting and pulling in of a car at the station can be accurately kept and verified by the time of the motormen. The unit of comparison as applied to electric street railways has not kept pace with the rapid changes which have been made in every feature of this industry during the past decade. The unit adopted by the steam railroads, the passenger-mile, was adopted by the street railways, but, owing to the impossibility of determining the distance each passenger was carried, that element was discarded, and, though its usefulness as a unit was impaired, it has continued to do duty as a standard unit to the present time. It applied very well to the old horse car, where the variation in speed was an unimportant factor, but time has wrought its changes, and a new unit to fit up-to-date conditions is deemed necessary.

With the past few years, a new problem has arisen owing to the construction and operation of high-speed electrical suburban and interurban lines. These are but the forerunners of what will shortly be in active and aggressive competition with the steam railroads. These lines will, doubtless, be controlled and operated by the street railway systems of the large cities, or at least in conjunction therewith; hence, creating a necessity for a unit of comparison applicable to both high and low-speed lines.

We believe that the objections raised to the car-mile as a standard unit in the paper presented at the last meeting of this association are logical, and that the motor car-hour meets all conditions better than any other unit yet advocated.

We herewith offer the following resolution for your consideration: "Resolved, That this association recommends the adoption of the motor car-hour as the Standard Unit of Comparison."

Departmental Accounts

BY H. L. WILSON, AUDITOR, BOSTON ELEVATED RAILWAY COMPANY, BOSTON, MASS.

In an unguarded moment I yielded to the request of our worthy president and agreed to prepare a paper on what he has seen fit to call Departmental Accounting. Three weeks ago the task was taken up for the first time, and it at once occurred to me that it was too broad a subject to attempt to cover in the limited time that should be devoted to a convention paper, and I so informed him and begged to be allowed to change it, but while he acknowledged it would be a difficult matter to digest, and as he put it, could be extended to the "length of the Holy Bible," he still insisted on my sticking to this title. If I was only sure that a book of this kind would have as large a circulation as the one he mentioned, I would give up accounting and go into the publishing business.

I will try, however, to give simply a rough outline of the system that we have adopted as the best method of handling labor and material accounts so as to have the maximum amount of quickly available information with the minimum amount of clerical help and expense, and trust that the members present will ask any questions that may suggest themselves, and in that way bring out any important points that may have been overlooked, as this is not submitted as any pet scheme, but simply as the best method that experience has suggested up to the present time.

In the first place I am strongly in favor of having all accounting, so far as possible, done in the main office of the auditor, rather than at the shops or department headquarters. There are several reasons for this, prominent among which are: That there must always be a responsible head to properly direct the efforts of others, and if it is all done in one place a really bright chief clerk may be employed, to whom a proper salary may be paid, who can have a supervision of all details, and any questions that arise can at once be referred to the auditor for his personal attention. Again there are times when the entire force can be put on some special and important piece of work that it is necessary to have completed at once; there are other times during the month when the pressure of work is such that some of the clerks can be engaged in collecting together the less important matters that have been allowed to accumulate during the busy time.

Another and very important reason is that there may be instances where estimates have been given of what certain work would cost, where the expenditures have greatly exceeded the estimate, and where it might be thought advisable by the head of the department to make transfers to other and improper accounts in order to substantiate the original figures.

When information is desired a question can as well be asked in one place as another, and certainly a more prompt and probably a more intelligent answer can be obtained from the place where all accounting is done than it would be possible to get by consulting several separate departments.

If, as is the case of the Boston Elevated Railway Company, there are several departments, any one of which may do certain work properly chargeable to another, it simplifies the accounting to be able to post the details to the proper account direct, and avoid the trouble of making charges and credits back and forth, which would be necessary if the accounting of the departments was done at separate places.

The four departments into which the construction, equipment and maintenance forces are divided are as follows:

Department of Motive Power and Machinery.
Department of Wires and Conduits.
Department of Buildings.
Department of Maintenance of Way.

No claim is made that the system as it is at present arranged is applicable as a whole to all companies, but the fundamental principle, which is the order number system, can certainly be applied to any road.

The method of issuing order numbers varies somewhat in the different departments.

In the shops the method is to have the superintendent or foreman give each class, and in many instances each piece of work performed, an individual number. The first order is numbered one and then they run along consecutively for two or three years or until there is no chance that by beginning over again the numbers will any way conflict.

When an order is issued a copy of it is sent to the Bureau of Audit so that the auditor may determine from the nature of the work the account to which it should be charged, entry is then made upon cards provided for this purpose which have headings for the Order Number, Account Charged, Date Issued, Date Completed and Description of the work. Below are printed spaces for the Month, for Labor, for Material and Invoices, for Shop Expense and for a Total of the above charges.

These cards are made double or folded over at the top, so that by using a small carbon sheet a duplicate can be made with only the labor of one entry. The advantage of this system is that by separating the card when the order is completed you have an opportunity of making any number of separate and complete lists without in any way interfering with the original files which can still be kept in their numerical order.

If you want to know what the charges have been to any account, what kind of work has been done for any department, an alphabetical list of all work or anything of this kind, it only requires a new deal of this extra pack to have the information in such shape that it can be quickly utilized.

The labor is reported weekly on sheets which have a heading for the Name, for the Date, for the Rate of Pay and for the Occupation; below are provided columns for the Order Number, for the Days of the Week, for the Total Hours and for the Amount. This sheet has some thirty-five lines, and provides in this way for a man who may work on thirty-five different order numbers during any one week.

The pay roll, of course, can be made by simply taking the total hours from the bottom of the sheet, while the charges to the order numbers are made by taking the amounts from the Amount column. These labor charges are abstracted on sheets of the same size as the time blanks, and all are then bound together in book form with these abstract sheets as the front pages, and the entries made upon the cards from this form. The advantage of this is at once plain; you have the card which shows you the date and you can quickly refer to the abstract, and if necessary by referring to the following pages you can at once tell the names of the men who worked upon the order as well as the days of the week and the hours each day that they devoted to this particular order.

The material used each month is reported on a sheet which has provision made in the printed heading to put in the Order Number, and below spaces for Quantity, Kind of Material, Price and Amount. These sheets are abstracted and bound in the same manner as the time sheets mentioned above.

We require all parties of whom we purchase supplies to use bill heads which we provide. These have spaces at the bottom in which to place all approvals and a space for a notation of the account to which the goods should be charged. Before adopting this idea, bills frequently reached my office in such a condition that it was difficult to read them, they being pretty well covered with rubber stamp impressions and signatures.

When charges apply to any department the bill is entered upon an invoice book which has spaces in which to make a copy of the invoice and enter the total amount, and separate spaces headed with the name of each department. These last spaces are subdivided into columns for Amount and Account to Charge.

By abstracting each of these columns you have all the information necessary to make your entries to the proper accounts, and the totals of all will prove the total of the invoice book.

Any general expenses of the shops are charged to an account called shop expense, and this is divided each month among the different order numbers under which work is being done.

The Department of Motive Power and Machinery has several subdivisions, such as Machine Shop, Car Equipment Shops, Car Repair Shops, Armature and Field Winding Shops, seven Power Stations, and has also charge of small maintenance crews in each of the thirty car houses.

I have explained the system of reporting all labor, material, etc., consumed at the shops, and the methods of making returns from the other places are so similar that I will not occupy your time with a description of the minor differences.

Blanks vary somewhat in the headings, but the idea that we have attempted to carry out is to have them all of a nearly uniform size so that they may be bound in the little booklets before referred to.

A large number of them are arranged in manifold books so that there is always an exact copy of what has been sent to the main office, and as each blank is numbered we at once know that something has gone astray if they do not run along consecutively.

By having a large cabinet with drawers arranged for each kind of report, ready reference can be made to any or all original time or material sheets.

In order to make a monthly report of the expenditures, it is of course necessary to compile the information you have on all these abstracts.

This is done on separate sheets for each shop, power station, etc. By having these sheets graduated in size so that the upper one is the narrowest, and each succeeding sheet just one column wider, you have all the totals together in a horizontal line, and a grand total is easily and quickly obtained by simply adding across. The widest or bottom sheet has on the right-hand side a sufficient space for the Names of the Accounts and a place for the ledger folio. In this manner the necessity of writing the title more than once is obviated and all necessity of journalizing is done away with, as these sheets bound together make a more complete and readily accessible journal than is possible to have by any other method.

For the Department of Wires and Conduits a different system of order numbers is used. It might be well to here call the attention to the fact that the company with which I am connected owns no surface tracks or their equipment, yet has in its immediate control and operates all the surface lines in the city of Boston and nearby suburbs under a lease for a term of years from the West End Street Railway Company.

This lease stipulated that the Elevated company should build no surface lines of its own, but that all additions to the surface lines or their equipment should be charged to and become the property of the West End Street Railway Company, and that credit should be given to the latter for any removals that were made.

It was, therefore, necessary to have a very complete and exhaustive record of all property, that could be quickly referred to and easily handled, and books of all kinds were considered, but none of them seemed to cover both of the above desirable elements.

Cards were then taken under consideration, and the great elasticity of this system at once recommended itself.

First index cards were prepared having for headings the names of each street, car house, bridge, etc., on the entire system.

The Electric Line Equipment had always been divided under five general headings: These were Poles and Setting, Overhead Feeder Lines, Overhead Trolley Lines, Underground Cables and Conduits, and Submarine Cables.

Cards were next provided for each separate kind of line equipment, and it was found that to give a complete analysis of the above five accounts would require the use of forty different forms of cards, and for quick reference it was decided to use several colors, as well as number each card on a small tab or projection from the top.

For Poles and Setting thirteen buff cards were used, which are numbered from 1 to 13 consecutively. The first four are used only for the four sizes of iron poles, which are the sole property of the West End Company. The next six are used for wooden poles, which are owned jointly by the West End Company and some other company. No. 11 is used for wooden poles owned exclusively by the company, No. 12 for special poles and bases, and No. 13 for span attachments to buildings.

For Overhead Feeder Lines eight cards were provided. They are blue in color, with tabs numbered from 14 to 21.

The first five of these cards are used to designate the amount and size of different kinds of feed and return wire. No. 19 is used for feed taps, No. 20 for switch boxes, and No. 21 for track connections.

For Overhead Trolley Lines three cards are used, being salmon in color, numbered, 22 which is used for bracket construction, 23 which is used for insulating joints, and 24 which is used for trolley wire.

For Underground Cables and Conduits eight cards were provided. They are buff in color, and are numbered from 31 to 38.

The first two numbers are used for Feeder Cables, the next three for Return Cables, the next for Feeder Cable Connection, the next for record of Conduit and Manholes, and the last for Conduit Connections.

The next eight cards are used for records of Submarine Cable for return wires; the first four, numbered from 51 up, are used for the Feeder Cables, the next four are used for Return Cables, and the last for Cable Houses, Switch Boxes, etc.

In order that the Wire and Conduit Department should report its expenditures in such a way that the Accounting Department could make the charges to the proper locations, a system of order numbers was devised to be used whenever additions to or removals from existing construction were made.

First each kind of equipment called for by the cards was given a number which corresponds with that on the tab of the card, and each street, car house and bridge on the entire system was given an individual number, commencing with 100. By preceding the number designating the street by the number designating the kind of equipment you at once have all the information necessary to tell to what location and to what account the labor and material should be charged.

This method furnishes many thousands of outstanding order numbers, any one of which can be readily selected from the printed list containing less than 600 numbers.

The labor is reported on the same form as that previously mentioned for shops, but the material sheet is somewhat different.

It is impossible for a foreman to always know exactly how much material will be used on any one job, and frequently he is called upon to work on several locations without going back to the stock room, and thus it is necessary to provide some form by which he can draw stock and report what he uses.

This is provided by a manifest, on the face of which is entered the material drawn. The back of this sheet provides for a report of the material used and a report of the material returned. The "Note" printed on the front side of the sheet reads as follows, and explains its use:

"NOTE.—This manifest is to be retained by the person responsible for the material issued upon it until every article is accounted for on the opposite side of this form.

"All material issued upon this manifest which is unused on the last day of the month must be returned to the storekeeper for in-

spection. The storekeeper will receipt for it, remanifest it or stamp this manifest 'Inspected,' as occasion requires."

These manifests are made in duplicate by the manifold system, and a correct copy of the original issue of stock is always in the keeping of the storekeeper.

At the end of the month the reports of the material used are abstracted on the same form mentioned for shop orders and are bound in the same manner.

The Department of Buildings is chiefly occupied with the repairs and renewals of buildings, and in order to answer all questions propounded by the management and by the Bureau of Real Estate a system of order numbers was gotten up for its use. The principle here employed is similar to that of the Department of Wires and Conduits; each kind of work has a classification number, and each building has one or more numbers which designate the building, and in some instances the different portions of the building. The method of reporting labor and material is the same as that used for the shops.

The Department of Maintenance of Way, as its name implies, has charge of the repair maintenance, inspection and construction of track and paving.

Order numbers are issued for any new work or for any extensive renewal or repairs by the civil engineer, who sends a notice to the head of the department and also to the bureau of audit.

The department is divided into eight divisions, called sections, and each carries a supply of the material they are continually using.

Each section's stock is carried under the following thirteen accounts:

Gravel.
Paving Stone and Flagging.
Lumber and Ties.
Nails and Spikes.
Rail Fastenings.
Tie-Rods and Buttons.
New Rail.
Old Rail.
Special Track Work, Frogs and Switches.
Miscellaneous Material.
Track-Welding Material.
Scrap Material.
Track Wiring Material.

When material is received at a section which is to be included in any of the above stock accounts, the person in charge immediately enters upon a form provided for that purpose the date, the firm's name or section from which it is received, and the quantity and kind of material.

These reports are numbered consecutively, and are sent to the bureau of audit, where all bills are entered on an invoice book which is abstracted each month, and from this abstract charges are made to stock accounts or to jobs direct.

When material is used or sent away, entry is made on a form which gives the date, where used or to whom sent, quantity and kind of material, price, amount, account to charges and account to credit.

These sheets are abstracted twice, once to get totals for the charges and once to get totals for the credits, and are bound and filed away in the usual manner.

When material is received from track taken up, or is returned from any work, it is entered upon a sheet which provides for the date, where from, quantity and kind of material, price, amount, account to credit and account to charge. These are abstracted and bound in the same manner as the Material Sent Away sheets.

All labor is reported on a form which has the usual heading, and provides below for a separation of Maintenance and New Construction charges, as well as the location where the work was done and the particular kind of labor that was performed. These are also abstracted and bound.

We will now suppose we have four kinds of bound books from which we are to make up our monthly report for the department.

We take a report blank and head it with the name of the section. This blank has columns provided for Approved Entries, for Each Kind of Material, for Approved Bills, for Labor, for Total Charges and Credits, and for Net Charges and Credits; and down the right-hand side has accounts to which charges and credits are to be made.

We then take the abstract of the invoice book and enter with red ink on the first line opposite the headings Approved Bills Charged to Stock the total charge to each kind of material; next we enter with black ink in the Approved Bill column all other items on the abstract, putting each one on the line opposite to the account to which it is to be charged.

Next we take the Material Used or Sent Away abstracts, and under the proper material headings and opposite the proper accounts we enter in black ink these items.

Next we take the Material Taken Up or Returned abstract, and with red ink enter under the proper material heading and opposite the proper account all these items.

Next we take the labor abstract and enter in red ink under the proper material headings the charges for labor on account of each stock account, and then enter in black ink in the column headed Labor and opposite the proper account all other charges.

There is one other column on the report sheet of which no mention has yet been made; this is the first one on the left-hand side, and is headed Approved Entries. This was provided to take care of journal entries, as the use of this report obviates the use of the customary journal.

Any entries necessary to transfer one account to another are made on journal blanks, and these are dated, numbered, bound together and abstracted, and from this abstract entry is made upon the report sheet.

By now footing these sheets across, you get the total charges and credits to each account, the black figures being debits and the red figures credits, and by footing the columns of material up and down you get all the debits and all the credits to each kind of material account; in this instance, however, the red figures are debits and the black figures credits.

Only one section has the accounts printed down the right hand side of the sheets; the others all leave off with the column headed Total Charges and Credits, and by placing these sheets side by side you have all debits and credits from all sections opposite the account, and the net debit or credit can at once be ascertained by adding these amounts together, and by carrying the net result into the column headed Net Charges or Credit you have only one amount for each account.

All items appearing in this column are then posted to their ledger accounts, and the footings of all material columns are debited and credited to their proper ledger accounts, and the sheets are the most complete and compact journal it is possible to have, as you can tell at a glance every item that went to make up the total of any account, and what section furnished the labor or material.

When any work of this kind is completed the superintendent of tracks sends a report to the auditor, giving the date that the track was finished.

A detailed statement of all labor and material charged is then made up, and this is sent to the civil engineer, who can at once tell from this report whether or not the proper amount of material has been charged, and he reports back in such a form that the information can at once be distributed on the cards provided for a report of the track mileage.

These cards number some seventeen. The first four are used to designate the different kinds of rail, and have spaces provided for the date, kind of paving, remarks, added, removed and amount.

The last three are used for a record of the three kinds of special track work, namely, girder, T and tram, and have additional columns in which to record the name of the maker and the type of work.

These cards, together with those provided for the electric line equipment, are filed in a cabinet back of the proper index cards, giving the name of the street or car house.

If at any time you wish to verify the records of any street, it is a simple matter to take all the cards for that location, put them in your pocket, and check them on the spot.

In closing, I would say that I have a set of blanks with me which I will be glad to show and explain to any member who wishes to look them over, and if it is thought advisable to publish this paper in the report of this convention it will give me great pleasure to arrange them in such a way that they can readily be referred to.

Material and Supplies Account

BY W. M. BARNABY, ACCOUNTANT, BROOKLYN RAPID TRANSIT CO.

I wish at the outset to state just what I am going to try and explain, and also to give the explanation with sufficient clearness to be understood.

Material and supplies account is but a branch of the book-keeping of any concern, and the method of keeping is to be determined by the results looked for. Some one has said that "book-keeping was but common sense properly applied." I trust that I can prove the truth of this saying as applied to the keeping of material and supplies account. In the first place what are the results to be obtained?

A correct record of all material and supplies received, showing kinds, quantities, price and from whom bought. A correct record of how used, showing the quantities and values as applied to operation, maintenance or construction, as the case may be.

A record which will show at any time the quantity of any particular stock on hand. A record that will show the various kinds of materials and their value charged to any particular expense or account.

These, I think, are the main results looked for in keeping material and supplies account. As a basis for accounting in this department of book-keeping the stock ledger is the first consideration. This book should contain the record of all receipts and all expenditures of material and supplies, and when inventory time comes around gives the value to material and supplies on hand. A stock ledger laid out with three accounts on a page is suggested, a book of 800 pages, giving some 2400 accounts. This should be opened with the accounts running alphabetically for convenience in locating. This is made so as to give each month practically a separate record. A trial balance can be taken monthly if desired.

The postings to this book are made from the record of materials received and from the consumption sheets which I will explain further on.

After the stock ledger comes the book containing the record of materials received, which, for convenience, we will call Book No. 2, the stock ledger being No. 1.

This book gives a complete record of all stock received, showing from whom received, quantity, price, kind, value, order number, Reg. No., how shipped, etc., in fact a complete record of each invoice. From this book the postings to the stock ledger are made. This book is made on the loose leaf plan, which permits a page, when filled up, to be taken out, allowing the posting to the stock ledger without interfering with the work of the receiving department.

We now come to the taking out of stock, and the method of changing to the proper expense or construction account.

All materials and supplies drawn from the stockroom should be drawn by order on the stock clerk, properly signed by those authorized to do so. The form of order is in duplicate, so that each department has a record of what materials or supplies it has used during the month. The order must also state for what purpose drawn. By taking the classification of expense accounts, as adopted by the Street Railway Accountants' Association of America, and giving the numbers and letters, the accounting part becomes very simple.

Any special expense or construction account can be kept by the mere giving of some special number or letter to indicate it. In this connection, it should be remembered that labor charges should be similarly treated to have uniformity of accounting.

Orders on the stock clerk are charged daily on the consumption blotter, which is made up of a number of sheets properly ruled. The consumption blotter is the record of quantities and values of materials and supplies used daily, the name of the materials or supplies being written in the margin and the quantity and the expense account being indicated. The unit of value is also given, being taken from the stock ledger.

After orders on the stock clerk have been posted on the consumption blotter the amounts thus charged are analyzed; first, as to the amount charged to each expense account; secondly, as to the value of each kind of material charged. The first result is, in turn, posted on blanks which are the final accounting as to expense or construction charged. The various accounts to be charged are written in at the top, and the result of the analysis of the consumption blotter is set down daily under the proper heading. At the end of the month the footings of these sheets give the cost of materials and supplies charged to each expense or construction account. The second analysis of the consumption blotter is transferred to other blanks for the record of amount used daily of each kind of materials or supplies, and from this the postings to the stock ledger are made, the value of the materials used balancing with the total amount charged to expense or construction accounts. This form has an additional value, in that it shows just the quantity of each material or supply used monthly, which is a good help to the stock-keeper in determining how large a quantity he should carry, and also enables him to make out his requisitions on the purchasing agent with intelligence. When more than one stock account is kept and goods are being transferred from one storeroom to another a proper transfer order should be used, which will indicate the kind, quantity and value of stock so transferred, and also indicate from and to what stock account transferred. These orders, which should be numbered, are treated by the stock clerk the same as any invoice, and should be posted in the record of materials and supplies account, and charged out in the regular course.

On the question of putting through material and supplies account bills covering large items, chargeable to construction, such as car bodies, trucks, motors, generators, etc., I think the method of direct charging preferable. At the end of each month the stock clerk should report to the auditor the amount of materials and supplies received, giving a list in detail of bills passing through his record of materials received, also the value of materials and supplies received through transfer from other stock rooms. This blank gives the quantity on hand on the first of the month, shows all debits and all credits to materials and supplies account, and enables the auditor to check the materials and supplies account, as shown by the stock clerk, with the general books of the company.

In connection with the stock ledger a card system is recommended. Each kind of stock having a card showing the quantity on hand, also stating the number of the bin, shelf or drawer in which it is kept. As the orders are filled by the stock clerk the cards are credited with the quantity taken out, so that the quantity on hand at any time can be ascertained. Some may say that the time involved would not warrant the keeping of such a system of cards, but I can state that a system covering between 5000 and 6000 different stock items can be posted in three hours. The value of knowing that a certain article is needed is obvious to any one familiar with the keeping in repair of car and motor equipments. By such knowledge an emergency order for the particular material or supply needed can be given and a "multitude of friction" thus covered. On this card, in addition to showing quantity on hand, a provision is made to show the quantity of such materials and supplies ordered, but not received, which provides against duplicate ordering.

In the matter of manufactured articles, such as commutator bars, field coils, etc., where the amount made up in a month might be sufficient for a much longer period, and it is desired to charge to the expense account only the amount used, the stock clerk would have to set a value upon the product, debit his material and supplies account, the same as for any purchased material or supplies, and set it upon his stock ledger, and reduce by a like amount his report of such expense accounts for the month. The custom is, I think, to charge direct to expense all material taken out of supplies for such manufacture, as though actually used during the month. Only a few of the larger companies do any manufacturing.

I think I have covered the principal features of material and supplies account. It may be that some of the minor details have escaped in condensing this into such a short article, but if there be any particular point not touched upon which some one is interested in, I trust he will not fail to make it known.

In any system of accounting, accuracy is the keystone, and that particular feature should never be lost sight of.

Storage Battery Cars *

BY M. BROCA, MANAGER OF THE COMPAGNIE DES TRAMWAYS DE PARIS ET DU DEPARTMENT DE LA SEINE, AND M. JOHANNET, ENGINEER OF THE COMPAGNIE GENERALE DE TRACTION, PARIS

This report considers the following question: What is the progress which has been made in the application of storage batteries to traction? (a) From the point of view of construction and reduction in weight of the batteries; (b) from the point of view of duration and cost of maintenance, and (c) from the point of view of their economical and practical application to tramway traction?

The information obtained furnishes no precise answer to these questions. Since 1892 the method of traction by storage battery has not been in favor. Such favorable results as those which have been obtained at Hanover, Germany, are because of particular conditions, and the general opinion is that storage battery traction should be used only when the overhead trolley cannot be operated, or when particular circumstances force its adoption.

At Paris, special conditions, such as trips of 19 km (12 miles) without recharging the batteries, 4 per cent grades and cars seating fifty persons, have compelled the adoption of heavier cars, 17.5 tons (38,580 lbs.), including passengers, than at Hanover. It is thought that if another system could be used it would be much more advantageous. But the city authorities forbid the use of the overhead trolley, so the systems left are in the order of cost of installation, as follows: (1) Storage battery, (2) surface contact, (3) underground trolley.

The cost of operation is just the reverse, but if the saving in interest on capital invested be taken into account it is certain that there will be some cases in which the storage battery system, if well conducted, is the best.

For this are necessary, (1) centralization of batteries, (2) construction by the company itself of strong plates, (3) slowest charging possible of the batteries, (4) proper study of the arrange-

* Abstract of report read before the International Tramway Congress, Paris, September, 1900.

ment of the batteries in the cars and also of their maintenance, (5) proper disposition of termini and charging stations.

The centralization of the batteries diminishes general expenses and increases the facility of inspection. The construction of plates has been done by us at a price not over f.0.10 (2 cents) above the current price of lead.

These batteries may not appear as good as more expensive ones, but they are more economical if everything is taken into account. In Paris they only run half the distance covered at Hanover, but we succeeded in the mechanical operation, and doubt if it can be done more cheaply.

The slow charging of the batteries is better because it does not impair the duration of the charge. By placing the batteries under the cars and using hydraulic methods of operation, we have succeeded in reducing the time of idleness of the car in changing batteries to forty seconds as the minimum, the maximum never being double that. It is to be noticed also that the battery alone is in idleness only one hour, as against ten minutes or fifteen minutes for the entire car under the rapid-charging method.

The arrangement of batteries and mode of handling adopted by the companies have utilized the existing rolling stock, etc., rather than provided more appropriate material.

The proper distribution of termini and stations permits great economy, easy inspection and efficient recharging of the batteries. The difficulties which have surrounded the question of location tend to disappear as its conditions are better understood.

In conclusion, it is easy to see that, while not partisans of the system of storage batteries, we think it ought not to be condemned in principle, if it is desirable to use electric traction and the overhead trolley cannot be adopted.

It is incontestable that this system requires less capital than the others; a portion of this capital is in the old lead, which has a market value; the system requires no special change in the tracks or even in the cars. It also allows of a better solution of the problem by the use of lighter batteries than the present lead ones, or of another method of storing the current, if it be discovered. The better distribution of load on the power plant greatly decreases the expenses of the generating station.

The facility of renewal is important as well as the fact that the track needs no special adaptation, and that the cars are absolutely independent of one another. In the case of light traffic, too, the storage-battery system may even be cheaper than the overhead trolley. The changes in roadway necessitated by particular circumstances, as the change from a single-track to a double-track line, or vice versa, to permit temporarily of street improvements, etc., must be considered. In short, where the overhead trolley is forbidden, as in Paris, the storage-battery system is a temporary solution.

The replies of eleven companies are attached to the report, of which only three use the storage battery—the Hanover Tramway Company, the Electric Traction Company, of Chicago, and the Compagnie Générale des Tramways, of Paris. The Hanover company is the only one which uses this system completely over any of its lines. The other companies employ a mixed method of traction.

In the Hamburg system, from Aug. 1, 1896, to Aug. 1, 1898, the storage battery cars ran 4,296,442,449 km at a cost of operation of 2.093 pfennig per car kilometer for each car. The mixed service trolley and storage was 8,168,888 km at a cost of 1.109 pfennig per car kilometer.

The Chicago Electric Traction Company ran its cars in 1898 over 35 miles of track, 10 miles of which was double track, at a cost of 43.75 centimes per car mile.

The Compagnie Générale des Tramways, of Paris, has a mixed system of trolley and storage battery, obtaining its power from the French Tudor Storage Battery Company for f.0.10 per car kilometer, and pays the operating expenses itself. This price is high because of the few cars, only five going 50,000 car km in a year. For that reason the company thinks the application of the system only feasible in particular cases.

Railway Power Stations*

BY M. THONET, GENERAL MANAGER OF THE SOCIETE D'ENTERPRISE GENERALE DE TRAVAUX, AT LIEGE, AND M. D'HOOP, OPERATING MANAGER OF THE SOCIETE DES TRAMWAYS OF BRUSSELS

This report is based on replies received to the following question sent to the members of the association:

What is the equipment and arrangement of the apparatus in your power station?

The object of this paper is to give the various methods employed at central plants and the practical results obtained. The information given by the various companies was too incomplete and uncertain to allow of a comparison of the results secured at the various stations, so the report is confined to particular points of certain plants.

Replies were received from sixteen companies, some operating large systems and possessing power plants of considerable magnitude. Several get their power from electric lighting companies already in operation, but still have been able to give information as to the equipment of the generating plant.

The replies received can be divided under the following heads:

1. Capacity of the plant.
2. Generators.
3. Engines.
4. Boilers.
5. Various apparatus.
6. Working of the plant.

CAPACITY

The capacity in the stations of the companies replying to the inquiry varied from that of the plant at Berlin of 13,500 kw in three power houses, and at Marseilles of 5000 kw in one power house to small plants of two generators (one for reserve) of 100 kw each. In general the capacity was double the power necessary for maximum service. As a general rule, for plants whose average power necessary is from 2000 kw to 3000 kw with a maximum of 4000 kw, the unit to be adopted is one-half the normal output, and three of these units should be installed, one to act as a reserve. The average of the maximum output is usually one-third more than that for normal service; but in some lines it is double.

The general proportion of the average current to the maximum is 1 to 1.5 or 1.7, rarely 1 to 2. In large plants composed of units of small power the number of units in operation is varied according to the variations required during the day.

GENERATORS

These are nearly always direct-connected to the engines, except when of less than 100 kw. They are generally compound, but some companies, with a view to the future use of storage batteries, use shunt machines. Their capacity for over-load is 25 per cent for one and one-half hours without more than 60 degs. increase above the surrounding temperature, but sometimes is 40 per cent over-load for one hour.

Most of the companies do not use storage batteries in parallel with the generators. Out of the sixteen companies reporting, six use storage batteries in this way. A seventh uses them because its machines are gas engines, and reduce variations in the current. In the case of gas motors the use of the battery is indispensable to economical operation.

Most of the tramways do not furnish the lighting current. At Hanover, however, of the six generating plants, four furnish lighting by means of special dynamos.

The Tramway Company of Brussels has two lines—one underground and the other overhead trolley, and consequently has two distinct generating systems.

ENGINES

In general, these are compound, except in France, where the one cylinder Farcot is much employed up to 1000 hp. The systems of distribution are the Corliss and Ryder, and the tendency is toward moderately high speed, with direct coupling. The number of revolutions varies from 65 r. p. m. to 120 r. p. m. in France, and from 95 r. p. m. to 150 r. p. m. in Germany and Belgium.

The engines are generally horizontal with jet condensers, except in Germany, where, for want of room, vertical engines with surface condensers are often used. At Berlin notably vertical engines are used in the Van de Kerkhove stations of the Allgemeine Company, which supplies power to the tramways. They are of 4000 hp, and run at from 100 r. p. m. to 110 r. p. m. The steam pressure in the compound engines is from 8 kg to 10 kg, and in the one-cylinder engines, 6 kg to 7.5 kg.

BOILERS

In Germany the boilers generally used are of the Gehre, Steinmüller, Cornwall, or Babcock & Wilcox type; in France and in Belgium the tubular boiler, the Piedboeuf type, the Babcock & Wilcox water tube, and the Denayer. They are of 10 atmospheres and 11 atmospheres for the Gehre boiler, 7 atmospheres to 8 atmospheres for the tubulars, and 8 atmospheres to 9 atmospheres for the Babcock & Wilcox, etc.

The heating surfaces varies from 150 sq. m to 250 sq. m. The grate surface varies from 2.5 sq. m to 6 sq. m per boiler.

* Abstract of paper read before the International Tramway Congress, Paris, September, 1900.

Many companies prefer the tubular boiler for large plants, in order to diminish as much as possible the maintenance of the boilers.

In general there is in reserve a third of the boilers necessary for maximum service.

The Tramway Company of Aix-la-Chapelle and the Compagnie Générale Francaise des Tramway at Nancy are the only ones which employ special boiler appliances. The first does not describe its apparatus or its functions. The second uses the Dubiau apparatus for accelerating the circulation of the water and increasing the output of the boiler. This apparatus has given a saving in fuel of from 15 per cent to 50 per cent in experiments conducted by the Boiler Inspection Association at Marseilles, Paris, Nancy, Douai, Bordeaux, Berlin, Leipzig, Milan and Vienna.

In general, mechanical stokers are not used, though some companies propose installing them. The boilers are cleaned every two or three months.

Few companies use smoke consumers. The chimneys in general are higher than 40 m, with an inside diameter of 3 m at the base and 2 m at the top.

One company, that at Orléans, owned by the General French Tramway Company, uses gas engines for an overhead trolley system. The engines are two of 165 hp each. The generators are direct-coupled, and have an output of 110 kw. The consumption of fuel in the gas generators averaged during a year 750 grammes of anthracite coal per kw-hour, inclusive of the lighting of the plant, and of 450 grammes per car kilometer, representing about 600 grammes of coal per hp-hour. This consumption is exceedingly low, and very economical compared to that of steam engines, even of large capacity.

VARIOUS APPARATUS

In general the feed water is heated only by the exhaust steam of the supply pumps. The temperature is not, on an average, raised by this means above 45 degs. C. Three stations use Green economizers. Four companies, having nine stations, use apparatus for superheating steam, and the degree of superheating varies from 40 degs. to 115 degs. C. All the apparatus is within the boilers. A single station reports the resultant saving at 3 per cent, which seems much lower than what is to be expected from superheating properly carried out.

No station reports the use of automatic lubricating systems. Condensers are used in all well planned stations where there is not an abundance of water. They are of two kinds. The "tower," rising to a great height and occupying small ground space, and the type more particularly used in France, are based on the breaking up of the water in contact with the atmosphere. This latter apparatus is placed above a basin in the open air and presents the inconvenience of taking up much room.

Only two companies use purifiers of water supply. But this is indispensable when some water is used, if incrustation and corrosion of boilers is to be avoided. A good purifier ought to be automatic, but its action should be watched very closely by taking samples once a day.

THE WORKING OF THE PLANT

The results most favorable for the vaporization obtained from various fuels are those of boilers with interior fire boxes, though little used by electric traction companies on account of their bulk. Their slow steaming properties, as compared with tubular boilers, is also an objection where it is necessary to rapidly follow the variations of load. The consumption of steam, leaving aside one plant not using a condenser, varies from 5.72 kg to 8.67 kg (12.6 lbs. to 19.1 lbs.) per ihp. The establishments using superheated steam give the greatest consumption. The saving in consumption seems to result from the construction of the boiler, and the method of distributing the steam.

The valve engines of the Corliss type are more economical than the slide-valve engines.

In the consumption of oil and lubricants there are enormous differences, both of 1 to 8 for cylinder oil, and of 1 to 20 for other oils. This question has not been sufficiently investigated in several power stations.

It is very difficult to state any conclusions as to running expenses from the figures furnished.

The conclusions to be drawn are that in large companies it is necessary to adopt compound steam engines with direct-connected generators, and to operate condensing. In average establishments it is advisable to add a storage battery to the plant. In small plants, if fuel is dear, the use of gas generators and gas engines give very good results.

The Operation of Secondary Railways*

BY E. A. ZIFFER, PRESIDENT OF SEVERAL RAILWAY LINES IN AUSTRIA

This paper is based on replies received to the following question sent to members of the association:

What are the advantages and disadvantages of the operation of local or secondary railways by independent companies, compared to their operation by the large trunk railroads to which they are tributary?

The only company to reply thoroughly to this question was the Société Nationale des Chemins de fer Vicinaux, of Belgium. This company, which is owned and controlled by the Government, has seventy-six lines in operation, all narrow gage, having a length of 1641 km. Of these it operates itself only two, aggregating in length 15.65 km. For the others a system of leasing is employed. The operation is given over to contracting companies, thus insuring decentralization and a sharing in the business by private capital. The cession is made by public adjudication, and for an indemnity calculated from special rules generally including a fixed sum, plus a percentage of the gross receipts.

There are three classes of these companies:

1. Companies operating lines of the National company and at the same time other lines on their own account or for third parties.
2. Companies which operate more than one line, but only those of the National company.
3. Companies operating only one line.

There are three methods of operation taken into consideration by M. Ziffer, deduced from his own experience:

1. Operation in trust or by management, which is the most desirable, on account of the freedom of the administrative officers and the absence of complication as part of a great railway system. Its managers can devote themselves solely to the betterment of their road without being influenced by the policy of the road with which it connects.
2. The operation of the road by a railway (private or governmental) to which it is attached or not. This method is only to be recommended when the capital of the secondary line is not sufficient to equip it with proper rolling stock, and with the necessary reserve fund. It is necessary also that the secondary line keep as much control as possible on the organization of the service and rates, and that the operating company share in the stock of the road.
3. Lease of the operation to an entrepreneur or operator. This method is especially desirable, and offers great advantages to both contracting parties.

Of these three systems the operation by a management is the most rational, and gives the best results, because the administration in trust guarantees absolute independence and allows a taking into account of the needs of trade, at the same time guarding the best interests of the project.

Car Heaters*

BY C. DE BURLET, GENERAL MANAGER OF THE SOCIETE NATIONALE DES CHEMINS DE FER VICINAUX

This paper is based on replies to the following question: What has been your experience with car heaters?

Since the report on this question at the convention of the International Tramway Association at Cologne, in 1894, no great progress has been made in car heating.

While this problem has been successfully solved for long-distance lines, the situation on tramways and short steam and electric lines is different, the elements to be considered being so various. The large number of windows, the doors at each end, the frequent stops causing the simultaneous opening of both doors, and consequent introduction of a cold current of air, are the principal causes preventing good effects, even from systems of heating better than those now in use. Added to this is the economy necessary on local lines, where the cost of first installation should not be above 12 per cent or 15 per cent of the value of the car.

The Convention of 1894 decided that it was not worth while to heat cars circulating within cities, but it was often necessary to heat suburban trains and cars. This report has been justified by the information gained this year. The heating systems to be

* Abstract of paper read before the International Tramway Congress, Paris, September, 1900.

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considered herein apply only to interurban or suburban tramways. Of these systems there are five:

(1). Heating by movable apparatus, *i. e.*, warmers of various kinds, etc.

(2). Heating by stoves.

(3). Heating by hot air.

(4). Heating by steam or hot water.

(5). Heating by electricity.

The first two of these have not been improved. Their disadvantages have often been pointed out. The system of heating by stoves is the simplest and most economical. The system of movable apparatus is more costly than that by stove. On a number of Belgian lines the cost for stoves was about f.35 per car, and the cost for fuel, coke or anthracite did not exceed 25 centimes for fifteen hours' service.

In heating by hot air the air is obtained from a fire either outside or within the car, with a system of conducting tubes to circulate the air. The cost of installation in one case (the Italian Northern, of Milan) was f.350 per car, the expense of operation 5 centimes per car-km. The system requires much care on the part of the train hands to keep the temperature within proper limits. At Utrecht heating by gas has been tried, but at a rather high cost of maintenance and operation, 80 centimes per day.

Heating by steam or hot water can be done in two ways.

(*a*). By distinct apparatus for each car.

(*b*). By taking the source of heat from either the locomotive or a boiler in the baggage car.

The first method has been applied to hot-water heating, but not to steam heating in the knowledge of the writer. All of the hot-water systems are of the thermosiphon type, and only vary as to the arrangement of distributing pipes. The cost of installation is as high as f.350 per car; of operation, 33.4 centimes per car day. The fuel employed is coal or charcoal. This system gives good results, the expenses are low, inspection easy, and it demands no special set of workmen. The greatest objection is the danger of freezing in the pipes. In spite of precautions, such as wrapping the pipes, etc., ice often forms in the tubes, necessitating their being taken apart.

The second system of this class, continuous heat by steam or hot water, has not been described by any of the companies asked. The Société Nationale des Chemins de fer Vicinaux of Belgium has made some experiments, which, however, have not been entirely satisfactory, because of the mixed composition of its trains. The results have been satisfactory as regards the temperature secured. With a pressure of 30 lbs. per sq. in. the temperature was raised 10 degs. to 12 degs. C. above that of the outside air. There was no freezing of tubes, etc. The cost of installation was f.350 per car. In this system, however, the same dangers of freezing as in the first system are present, in fact are even greater, because the source of heat, the locomotive, is often detached from the cars.

Only one company reports the use of electric heaters, the tramway company of Hanover, which used them on its suburban cars. The cost of installation was M.40 per car, and of operation about 10 pfg. per car-hour, or about f.12 for a service of sixteen hours.

None of the systems examined has shown any real advance on what has been done previously, probably because of the peculiar conditions of the problem, and their variation from line to line. Therefore, it is not possible to formulate any conclusions, and the matter can well be left open for consideration at future meetings of the Union.

Power Distribution for Electric Railways*

BY M. VAN VLOTEN, ELECTRICAL ENGINEER AT BRUSSELS

This paper is based upon answers received from members of the association in reply to the question: "What is the best system of power distribution for long electric railways?"

This problem is very complex, and the question is too general for any solution, except in well determined cases. We will therefore be content with the examination of the systems employed or proposed at present, viz.:

(A). Distribution by direct current.

(B). Distribution by alternating current.

(C). Distribution by alternating and direct current at the same time.

(*A*). *Distribution by direct currents:*

(1). Ordinary distribution at 550 volts or 600 volts, and single central station: This is the most general system for city and suburban electric railways, but is not well suited to lines having long extensions, because the low voltage used makes the loss excessive when the power is transmitted any considerable distance. The advantages all lie in those resulting from the use of a single central station, as ease of surveillance, reliability of operation, continuous-current motors, etc. The disadvantages are the cost of distribution, increasing rapidly with the distance, and danger of electrolysis. In ordinary cases this system is not advisable for lines longer than 8 km or 10 km from the power house or central station.

(2). Same distribution, but with two or more central stations: Compared with the former, the advantages of this system are: Important reduction in outgoing and return feeders, reduction in line losses and in the dangers of electrolysis. The disadvantages of several power stations are increased cost of installation and operation, less facility of surveillance, etc.

(3). Same distribution as in No. 1, but with boosters: Its advantages are those of the single central station, and sensible reduction in copper. The use of boosters allows an extension of the zone of action of the power house without any change in the station equipment. Its disadvantages are higher net cost per watt-hour, and greater complications at the power station. In most cases this system has many advantages, except with very long lines or with very heavy traffic.

(4). Distribution by the three-wire system, the rails serving as a neutral conductor. The advantages of this system are reduction of the weight of copper in the distribution, single central station, etc. But this system has not met with general adoption, because of the difficulty of maintaining equilibrium between the two sides of the system, difficulties with insulation at crossings, turnouts, etc.

(5). Distribution at high tension, with secondary stations reducing the voltage to 550 volts or 600 volts.

(a). Parallel system: This is little used, because of inherent troubles in high-voltage direct-current motors and generators, and the transmission lines are more expensive to install the higher the voltage. It is also more difficult to maintain the insulation of cables as the voltage increases.

(b). Distribution in series (Thury system). This system is suited for long distances (30 km to 40 km and upward). It consists of distributing power by direct-current generators, and having at the points of use direct-current motors, which, in turn, drive standard 500-volt to 600-volt railway generators. The generators and motors are series-wound and are connected in series. As there are several generators and several motors on each circuit, the voltage at the terminal of each is reduced to reasonable limits. The final distribution is on the ordinary multiple-arc system. The advantages of this system are reduction in the weight of copper in the transmitting lines, economical transmission and adaptability of the receiving stations, either for electric lighting or distribution of power. It has the great advantage of every distribution in series that the current has to pass through all the generators and receivers. This system is not well adapted to use by tramways, being more applicable to power transmission and electric lighting.

(6). Traction by storage battery.

(a). Ordinary system: This system is suited to lines having a light traffic. It has great advantages from the point of view of economy of installation, absence of dangers of electrolysis, facility of using any track, etc.

Its disadvantages are: Greater weight of car, etc.; less reliability of operation, increased number of charging stations, unless the system is limited to lines of 15 km to 20 km, because of the limited capacity of the batteries.

(b). Mixed system, trolley and storage batteries. This system permits the operation of lines longer than 15 km or 20 km. Its value depends on the extent to which the trolley system can be used, but this consideration aside, it does not present any marked advantages over the preceding.

(*B*). *Distributions using polyphase currents.*

One-phase alternating-currents are not suitable for electric traction, because the one-phase, asynchronous motors do not start under a load, and demand a relatively high weight of copper for the conductors, and finally the output of the alternators and transformers is low, etc. Two-phase motors are also impracticable, as they necessitate the use of four conductors. The system to be considered, therefore, is the three-phase.

The systems under *B* can be divided into two kinds. (a) Systems in which the car motors are supplied directly with the line potential, and (b) where transformers are used. The former is little used, because of the difficulty of insulation, greater danger to the public, self-induction of the rails, disturbance in telegraphic and telephonic communications, etc. By the second system these difficulties are removed almost entirely.

(*C*). *Distributions by the alternating direct-current system.*

This system can be divided into (a), that in which the initial current is generated at a high potential, and (b), where low voltage generators are used, and the current is stepped up to the transmission voltage. The advantages of both lie in the use of direct-

* Abstract of paper read before the International Tramway Congress, Paris, September, 1900.

current motors, with distribution at high potentials. The disadvantages are the cost of the transforming machinery and the loss in efficiency and simplicity.

In concluding, I will present a table taken from an article in the *Electrotechnische Zeitschrift,* by M. Huber, giving certain costs of each of the different systems, as applied to a road 20 km in length, operating five trains of 20 (metric) tons each, each requiring about 20 kw. The figures given are only those in which the systems differ from each other. Those costs which are common to all are omitted.

Type of System	Electrical Equipment of Power Station	Copper in Trolley and Feeders	Transformers	Sub-Station Apparatus	Transmission Line	Total Cost	Interest and Depreciation, Copper at 6 per cent; Machines at 10 per cent	Annual Wages of Employees at Stations	Sum of Interest, Depreciation and Annual Wages
Power Station in Middle of Line									
Direct current	70,000	45,000	.....	.....	.....	115,000	9,700	3,600	13,300
Alternating current	70,000	41,000	24,000	.....	.....	135,000	11,860	3,600	15,470
Power Station at End of Line									
Direct current	70,000	180,000	.....	.....	.....	250,000	17,800	3,600	21,240
Alternating current	70,000	44,000	24,000	.....	.....	138,000	11,040	3,600	15,640
Power Station at End of Line									
Alternating direct current	100,000	28,000	.....	80,000	10,000	218,000	20,280	7,200	27,480
Power Station 10 km from Middle of Line									
Alternating direct current with sub-station at middle of line	70,000	45,000	.....	100,000	25,000	240,000	21,100	7,200	28,300
Purely alternating system	70,000	41,000	24,000	.....	25,000	160,000	13,370	7,200	18,770

All figures are cost in francs.

The Rating of Motors*

BY M. MACLOSKIE, CONSULTING ENGINEER OF THE COMPAGNIE INDUSTRIELLE DE TRACTION IN FRANCE

This paper is based upon the following questions: Is a standard rating for electric motors and generators possible? What should it be based upon? Can the same rating be applied to other electrical machinery used on electric railways?

The reporter reverses the order of the questions, and answers the last first. That is, he thinks it possible to adopt a single method of rating applicable to all electric railway apparatus. For example, for car controllers the criterion is the maximum current-carrying capacity, either with or without resistances. The same is true of the circuit breakers, etc., although, as all of this auxiliary apparatus is usually purchased and always used, together with the car equipment, its rating can be determined by that of the motor.

As to the second part of the question, when the basis of rating has been settled, it would seem a simple matter to prepare tables, from which the output of motors working under practical conditions can be given.

Considering now the basis of rating, the writer believes the present basis, *i. e.*, horse-power, to be unsatisfactory, for the reason that such a rating does not always convey an idea as to the length of time at which the motor can carry its load. For this reason certain manufacturers have suggested a rating based on the output, when the heating of the motor during one hour's operation reaches a given value.

The following rule is, therefore, proposed: The nominal power is to be rated by the work expressed in kilowatts, furnished to the motor under a regulation which fixes the rise in temperature, as measured by a thermometer, either on the fields or the armature, to not more than 750 deg. C. above the temperature of the surrounding medium, which should be from 10 degs. to 20 degs. C.

The writer then discusses the question of speed, efficiency, etc., and finally recommends a designation for motors, made up of three facts, which, for convenience, can be designated as A, B, and C.

A is the current, in milliamperes, required to produce 1 kg of tractive effort at the periphery of wheels 800 mm in diameter. This factor varies to a certain extent with the speed, and is larger as the speed increases.

B is the current, in amperes, required to compensate for all mechanical and electrical losses in the motor. It is, in effect, a measure of the efficiency, but should, of course, be considered in connection with its relation to A, and to the weight of the motor. In modern motors B is not far from the weight of the motor, multiplied by A and divided by 5000. For very heavy motors this rule is only approximate.

C is the kilowatts input of the motor under such a load that operating continuously under it for one hour the temperature of the motor does not rise 75 degs. C. above the surrounding air, as described above.

The author recommends these data to be written in the order C, A, B. He gives as constants for several well known motors, the following:

G. E. 1200 A = 125, B = 30.
G. E. 2000 A = 161, B = 45.
G. E. 51 B-6 C = 70, A = 162, B = 29.

* Abstract of paper read before the International Tramway Congress, Paris, September, 1900.

Effect of Introducing Electricity on Tramways*

BY E. VON PIRCH

Abstract of report submitted by Director E. von Pirch, of Barmen-Elberfeld, based on replies received to the following questions:

What results were obtained from the introduction of electricity on your lines in regard to (1) the traffic; (2) the operating expenses; (3) the net profits?

The replies received showed that the change was only made in a number of large cities by horse car lines and roads operating locomotives, and the overhead trolley was the system generally chosen. The replies, however, are sufficiently exhaustive to permit of general conclusions to be drawn.

The following advantages of electric over horse service were brought forward:

(1) On account of the greater average speed, the number of cars doing the same service could be decreased and the number of trips per day increased; the same holds true for the employees. On account of the greater speed also the cars are finding more favor with the public.

(2) As trailers can be used, the elasticity of the electric system becomes an admirable feature, as it is in a better position to care for the largely increased traffic on Sundays and holidays.

(3) The electric draw-bar pull makes it possible to traverse roads which on account of their heavy grades could not be traversed by horse cars.

(4) The cost of operation of electric cars where dense traffic exists in thickly populated districts, and even where cost of current is high, is less than that of horse cars, which cost is even lessened when trailers are used.

(5) On account of the above advantages lower fares can be charged without endangering the profits of the company.

(6) On down grades no power is wasted.

(7) No time is wasted in hitching up and unhitching horses.

(8) The streets are kept cleaner, the pavement is abused to a less degree, and the traffic is not so much interfered with.

(9) It is easier for an electric car to surmount difficulties encountered on the road while work is being done on the same.

(10) As the horse car must be made light on account of the pulling capacity of the horse, the weight need not be considered with an electric car, which can be designed with a view to giving comfort to the passengers. In fact, larger and heavier motor cars and trailers can be used, not beyond the capacity of the motors, without materially increasing the operating expenses.

It has also been found that the electric service possesses the following advantages when used on small trains with small headway, when compared to locomotives: It is cheaper, can surmount heavy grades, and does not annoy the public with smoke, steam and noise.

Actual statistics submitted in reply to the above questions show the following distinct advantages:

(1) Increase in traffic, and therefore more passengers per km traveled. This was shown at Havre, Marseilles, Barmen, Hamburg, Leipzig, etc.

* Abstract of paper read before the International Tramway Congress, Paris, September, 1900.

(2) Extension of the system from the city to neighboring towns, especially over hilly roads where horse and steam cars are out of the question.

(3) The cost of operation is reduced and the net profits are increased, as shown at Aachen, Barmen, Hamburg, Leipzig, etc.

(4) The possibility to reduce fares and introduce and extend the system of transfers.

(5) The installation of more comfortable and larger cars, without materially increasing the operating expenses.

Among the special considerations which affect the decision as to the introduction of electricity the following should be mentioned: Money to be paid to the city to pay for pavement of streets; the cost of current; the voluntary or compulsory use of a costly electric system; the conditions imposed by the franchise and matters relating to the capitalization; æsthetic conditions imposed by the authorities which require expensive construction; the duration of the franchise; taxes to be paid to the city, etc.

It has, in fact, been aptly stated by a well known railway man that the electric service is only advantageous where the distances traveled are great, the traffic large, where the franchise extends over a long period, and where the system to be used and the condition of the road have been carefully considered. On an even roadbed, and without the above conditions being fulfilled, the electric system cannot easily compete against the horse.

We arrive, therefore, at the following general conclusions: The overhead electric system possesses advantages over the horse car system only when the trains run frequently, over long lines with heavy traffic, especially where many grades are present, provided that the franchise extends over a long enough period and when it imposes no impossible conditions.

Representatives of Electrical and Street Railway Papers at the Kansas City Convention

James H. McGraw, Street Railway Journal and *American Electrician*, New York.
Henry W. Blake, Street Railway Journal, New York.
J. B. Bennett, Street Railway Journal, New York.
James R. Cravath, Street Railway Journal, Chicago.
C. S. McMahon, Street Railway Journal, Chicago.
W. K. Beard, Street Railway Journal and *American Electrician*, Philadelphia.
J. M. Wakeman, *Electrical World and Engineer*, New York.
J. V. S. Church, *Electrical World and Engineer*, Chicago.
Frank E. Colbert, *Electrical Review*, Chicago.
Stephen H. Goddard, *Electrical Review*, New York.
Charles W. Price, *Electrical Review*, New York.
George A. Barnes, *Street Railway Review*, Chicago.
Charles B. Fairchild, Jr., *Street Railway Review*, Chicago.
Fred. Kenfield, *Street Railway Review*, New York.
H. J. Kenfield, *Street Railway Review*, Chicago.
Daniel Royce, *Street Railway Review*, Chicago.
Henry H. Windsor, *Street Railway Review*, Chicago.
Charles H. Perrine, *Tramway and Railway World*, Chicago.
Charles Sanford Clarke, *Western Electrician*, Chicago.
W. Forman Collins, *Western Electrician*, Chicago.
C. E. Kammeyer, *Western Electrician*, Chicago.
William E. Keily, *Western Electrician*, Chicago.
T. E. Crossman, stenographer, Street Railway Association, New York.
A. B. Weaver, stenographer, Accountants' Association, Buffalo.

Fire Destroys Car Houses at Cleveland

The car houses of the Cleveland & Eastern Railway Company at Gates Mills were destroyed by fire a few days ago, entailing a loss of $100,000. Seven new cars, recently received from the manufacturer, and valued at $5,000 each, were lost, also two steam locomotives, formerly used by the company. The power house, which adjoins the car houses, was saved after a desperate struggle with the flames.

Accident in Paris Underground Road

Two trains of the Metropolitan Underground Railroad, of Paris, collided Oct. 19, and twenty-nine persons were injured. The accident occurred between the Exposition Station, on the Champs Elysées, and the Place de la Concorde. A train entered the Place de la Concorde Station, backed out again, and the train following, owing to a misunderstanding of signals, crashed into the rear carriage. Luckily, both trains were going slowly. Nevertheless, the shock smashed the end of the car, shattered the windows of both trains, and extinguished the electric lights. There was great excitement, the darkness in the tunnel adding to the general alarm.

Ladies at the Kansas City Convention

Mrs. W. S. Dimmock, Council Bluffs, Ia.
Mrs. John M. Roach, Chicago.
Mrs. F. L. Roach, Chicago.
Mrs. John Ehrhardt, Cleveland.
Mrs. W. G. McDole, Cleveland.
Mrs. Ira A. MacCormack, Cleveland.
Mrs. W. J. White, Cleveland.
Mrs. W. H. Harris, Cincinnati.
Mrs. J. B. Hogarth, Denver, Col.
Mrs. G. Van Ginkel, Dallas, Texas.
Mrs. Robert S. Goff, Fall River, Mass.
Mrs. H. F. MacGregor, Houston, Texas.
Mrs. James M. Jones, Indianapolis, Ind.
Miss L. R. Klott, Jersey City, N. J.
Mrs. Walton H. Holmes, Kansas City.
Mrs. C. F. Holmes, Kansas City.
Mrs. L. E. James, Kansas City.
Mrs. W. A. Satterlee, Kansas City.
Mrs. J. W. Carter, Kansas City.
Mrs. W. G. Becker, Kansas City.
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Mrs. D. W. Dozier, Kansas City.
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Mrs. Albert M. Patten, Topeka, Kan.
Mrs. J. M. Smith, Toronto, Canada.
Mrs. E. J. Spencer, Venice, Ill.
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Mrs. A. A. Anderson, Youngstown, Ohio.
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Miss Hoff, New York.
Miss Wells, New York.
Miss Crosby, New York.
Mrs. F. E. Donohoe, New York.
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Mrs. R. S. Deming, Chicago.
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Mrs. Victor Angerer, Philadelphia.
Mrs. Theodore P. Bailey, Chicago.
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Mrs. H. M. Grier, New York.
Mrs. John M. High, New York.
Mrs. W. R. Garton, Chicago.
Mrs. W. H. Cord, Chicago.
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Mrs. A. L. Haasis, Jersey City, N. J.
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Miss M. Biergman, New York.
Miss A. Biergman, New York.
Mrs. D. F. Webster, Sedalia, Mo.
Mrs. W. F. Waller, Sedalia, Mo.
Mrs. F. W. Kinmouth, Sandy Hill, N. Y.

LIST OF MEMBERS OF THE ASSOCIATION IN ATTENDANCE AT THE CONVENTION

Akron, Ohio.—L. E. Beilstein, general manager Northern Ohio Traction Company.

Asbury Park, N. J.—S. F. Hazelrigg, general manager Atlantic Coast Line Electric Railroad Company.

Atchison, Kas.—J. A. Bendure, general manager Atchison Railway, Light & Power Company.

Atlanta, Ga.—Ernest Woodruff, president; J. R. Gordon, director, Atlanta Railway & Power Company.

Augusta, Ga.—D. B. Dyer, president; C. O. Simpson, secretary and treasurer, Augusta Railway & Electric Company.

Birmingham, Ala.—J. B. McClary, general manager; D. B. Dimick, electrical engineer; George H. Harris, chief engineer, Birmingham Railway & Electric Company.

Boston, Mass.—Charles S. Sergeant, vice-president; Henry L. Wilson, auditor, Boston Elevated Railway Company.

Bridgeton, N. J.—H. J. Crowley, vice-president; B. Frank Hires, general manager, Bridgeton & Millville Traction Company.

Brockton, Mass.—Elwin C. Foster, general manager Brockton Street Railway Company.

Brooklyn, N. Y.—Clinton L. Rossiter, president; Eugene Chamberlin, superintendent of equipment; William Robbins, Jr., division superintendent; Newton W. Bolen, division superintendent; Giles S. Allison, general sales agent, Brooklyn Heights Railroad Company.

Brookfield, Mass.—E. P. Shaw, Warren, Brookfield & Spencer Street Railway Company.

Buffalo, N. Y.—C. A. Coons, superintendent Buffalo Railway Company.

Camden, N. J.—Walter E. Harrington, general manager Camden & Suburban Railway Company.

Chester, Pa.—John A. Rigg, president; Joseph C. Lugar, superintendent, Chester Traction Company.

Chicago, Ill.—H. M. Sloan, general manager Calumet Electric Street Railway Company; Robert McCulloch, general manager; T. C. Penington, treasurer; C. N. Duffy, auditor; C. E. Wilson, chief engineer; M. O'Brien, master mechanic; John Sills, assistant master mechanic; C. E. Lund, draughtsman, Chicago City Railway Company; John M. Roach, president; T. A. Henderson, general superintendent; F. L. Roach, Chicago Consolidated Traction Company; E. R. Gilbert, general manager Chicago Electric Traction Company; John M. Roach, president; J. Millar, master mechanic; George Voigt, electrician, Chicago Union Traction Company; William Walmsley, superintendent South Chicago City Railway Company.

Cincinnati, Ohio.—W. H. Harris, Cincinnati Street Railway Company.

Cleveland, Ohio.—John Ehrhardt, assistant secretary; C. B. Easty, master mechanic, Cleveland City Railway Company; Ira A. MacCormack, general manager; W. G. McDole, auditor; E. C. Faber, general passenger agent; W. J. White, Cleveland Electric Railway Company.

Colorado Springs, Col.—Frank C. Lawton, superintendent Colorado Springs Rapid Transit Railway Company.

Columbia, Pa.—Frank S. Given, general manager Canostoga Traction Company.

Columbus, Ohio.—Michael S. Hopkins, general superintendent; P. V. Burington, secretary and auditor, Columbus Railway Company.

Council Bluffs, Ia.—W. S. Dimmock, general manager; W. G. Denny, foreman of shops, Omaha & Council Bluffs Railway & Bridge Company.

Dallas, Tex.—G. Van Ginkel, president Dallas Consolidated Electric Street Railway Company.

Danville, Ill.—Samuel L. Nelson, general manager; Harry Evans, Danvillle Street Railway & Light Company.

Dayton, Ohio.—Charles L. S. Tingley, secretary and treasurer People's Railway Company.

Denver, Col.—J. B. Hogarth, Denver City Tramway Company.

Des Moines, Ia.—A. G. Maish, secretary; W. G. Owens, superintendent; E. R. Emmons, J. E. Welch, Thomas Marlow, Des Moines City Railway Company.

Davenport, Ia.—James F. Lardner, general manager; John G. Huntoon, general superintendent; John D. Fish, electrical engineer, Tri-City Railway Company.

Detroit, Mich.—A. L. Parker, second vice-president Detroit, Rochester, Romeo & Lake Orion Railway Company.

Fall River, Mass.—Robert S. Goff, president Globe Street Railway Company.

Findlay, Ohio.—C. D. Kinney, vice-president and treasurer; Charles F. Smith, manager, Findlay Street Railway Company.

Fond du Lac, Wis.—T. F. Grover, president Fond du Lac Street Railway & Light Company.

Hamilton, Ont.—C. K. Green, manager; J. B. Griffith, purchasing agent, Hamilton Street Railway Company.

Harrisburg, Pa.—Mason D. Pratt, engineer Harrisburg Traction Company.

Hazleton, Pa.—C. A. Bragg, Lehigh Traction Company.

Hoboken, N. J.—W. S. Hall, general superintendent North Hudson County Railway Company.

Houston, Tex.—H. F. MacGregor, vice-president and general manager Houston Electric Street Railway Company.

Indianapolis, Ind.—James M. Jones, second vice-president; W. F. Milholland, treasurer and assistant secretary; Edward P. Burch, consulting engineer, Indianapolis Street Railway Company.

Jackson, Miss.—Frank G. Jones, Jackson Railway, Light & Power Company.

Jersey City, N. J.—E. D. Hibbs, auditor; G. F. Chapman, general superintendent; A. W. Pratt, roadmaster, North Jersey Street Railway Company.

Johnstown, Pa.—H. C. Evans, director Johnstown Passenger Railway Company.

Joliet, Ill.—Samuel G. De Coursey, president; F. E. Fisher, general manager; A. S. Kibbe, engineer, Joliet Railway Company.

Kalamazoo, Mich.—J. B. Foote, chief electrician; R. L. Rand, general superintendent, Michigan Traction Company.

Kansas City, Kas.—W. H. Gabriel, vice-president; Herbert W. Wolcott, secretary; E. E. Comb, manager; H. E. Gabriel, assistant manager; H. S. Neefe, superintendent; W. H. Hammond, passenger and claim agent; C. K. Stieg, electrical engineer, Kansas City-Leavenworth Railway Company.

Kansas City, Mo.—W. O. Hands, general manager; Charles E. Jack, auditor; H. De Coursey, East Side Electric Railway Company; Walton H. Holmes, president; C. F. Holmes, general manager; L. E. James, vice-president; D. B. Holmes, counsel; W. E. Kirkpatrick, secretary and treasurer; J. A. Harder, auditor; W. A. Satterlee, superintendent; J. W. Carter, assistant superintendent; H. C. Schwitzgebel, purchasing agent; D. W. Dozier, chief engineer; W. G. Becker, master mechanic; Charles Grover, electrical engineer; Edward Butts, line engineer, Metropolitan Street Railway Company.

Knoxville, Tenn.—Robert Kinsell Howard, superintendent Knoxville Traction Company.

Lebanon, Pa.—Dr. Walter A. Rigg, director; K. A. Fichthorn, director, Lebanon Valley Street Railway Company.

Lowell, Mass.—E. C. Foster, general manager Lowell, Lawrence & Haverhill Street Railway Company.

Louisville, Ky.—T. J. Minary, president; T. H. Minary, assistant superintendent of construction; Samuel G. Boyle, secretary and treasurer, Louisville Railway Company.

London, Ont.—C. E. A. Carr, general manager, secretary and treasurer; E. R. Carrington, London Street Railway Company.

Lynn, Mass.—E. C. Foster, general manager Lynn & Boston Railroad Company.

Memphis, Tenn.—Frank G. Jones, vice-president and general manager Memphis Street Railway Company.

Meriden, Conn.—N. H. Heft, president Meriden Electric Railroad Company.

Meridian, Miss.—John Kamper, Meridian Street Railroad & Power Company.

Merrimac, Mass.—James F. Wattles, director; Charles S. Clark, director, Haverhill & Amesbury Street Railway Company.

Milwaukee, Wis.—John I. Beggs, general manager; T. E. Mitten, general superintendent; G. J. Sunny, special agent, Milwaukee Electric Railway & Light Company.

Nashville, Tenn.—F. W. Child, director Nashvillle Street Railway.

New Orleans, La.—W. B. Brockway, assistant secretary and auditor New Orleans & Carrollton Railroad Company.

New York, N. Y.—Herbert H. Vreeland, president; Dr. J. J. Higgins, physician, Metropolitan Street Railway Company.

North Adams, Mass.—W. T. Nary, superintendent Hoosac Valley Street Railway Company.

Norristown, Pa.—John A. Rigg, president; Samuel D. Missimer, chief engineer, Schuylkill Traction Company.

Oil City, Pa.—James H. Forbush, superintendent Oil City Street Railway Company.

Omaha, Neb.—W. A. Smith, general manager; F. A. Tucker, general superintendent, Omaha Street Railway Company.

Ottawa, Ill.—F. S. Donnell, president Ottawa Railway, Light & Power Company.

Ottawa, Ont.—J. E. Hutcheson, superintendent Ottawa Electric Railway Company.

Pasadena, Cal.—W. H. Smith, general manager Los Angeles & Pasadena Electric Railway Company.

Peoria, Ill.—L. E. Myers, general manager; N. C. Draper, superintendent, Peoria & Pekin Terminal Railway Company.

Philadelphia, Pa.—John A. Rigg, president; C. C. Long, electrical engineer, Holmesburg, Tacconey & Frankfort Electric Railway Company; John A. Rigg, president; George Hoeger, superintendent, Roxborough, Chestnut Hill & Norristown Railway Company.

Pittsburgh, Pa.—George S. Davison, general manager Monongahela Street Railway Company; Charles Fitzgerald, superintendent; Robert T. Todd, general master mechanic, consolidated Traction Company; C. S. Mitchell, auditor United Traction Company.

Port Chester, N. Y.—G. Stanley Heft, electrical engineer Port Chester Street Railway Company.

Portland, Maine.—W. R. Wood, president; E. A. Newman, general manager; C. C. Pierce, general electrician, Portland Railway Company; William E. Dow, assistant superintendent; George E. Raynes, starter, Portland & Yarmouth Electric Railway Company.

Port Huron, Mich.—A. Dixon, president; W. L. Jenks, treasurer; H. A. Dixon, manager, City Electric Railway Company.

Quincy, Ill.—W. B. McKinley, secretary; L. O. Williams, superintendent, Quincy Horse Railway & Carrying Company.

Quincy, Mass.—John R. Graham, president and general manager Quincy & Boston Railway Company.

Reading, Pa.—John A. Rigg, president; Samuel E. Rigg, superintendent, United Traction Company.

Rochester, N. Y.—J. H. Stedman, manager of transfers Rochester Railway Company.

Rockford, Ill.—R. N. Baylies, president; T. M. Stephenson, manager, Rockford Railway, Light & Power Company.

Salt Lake City, Utah.—Walter P. Read, superintendent Salt Lake City Railroad Company.

Saratoga, N. Y.—E. A. Noyes, president; F. P. King, general manager, Saratoga Traction Company.

Schenectady, N. Y.—J. R. Lovejoy, director; W. Gibson Carey, director, Schenectady Railway Company.

Seattle, Wash.—Charles F. Wallace, engineer Seattle Electric Company.

Sioux City, Ia.—J. Henry Ricker, secretary; E. O. Holmes, superintendent; C. M. Feist, master mechanic, Sioux City Traction Company.

Spokane, Wash.—L. R. Notbohm, superintendent Washington Water Power Company.

Springfield, Ill.—C. K. Minary, manager; T. H. Minary, electrical engineer, Springfield Consolidated Electric Railway Company.

Springfield, Ohio.—John H. Miller, general manager Springfield Railway Company.

St. Joseph, Mich.—W. Worth Bean, president St. Joseph & Benton Harbor Electric Railway & Light Company.

St. Joseph, Mo.—W. T. Van Brunt, vice-president and general manager; J. H. Van Brunt, superintendent; T. C. Smallwood, O. T. Kass, St. Joseph Railway, Light, Heat & Power Company.

St. Louis, Mo.—Thomas M. Jenkins, general manager; Herbert O. Rockwell, assistant to general manager; Nathan Smith, electrical engineer; Charles S. Butts, E. J. Smith, T. C. Kimben, St. Louis & Suburban Railway Company; George W. Baumhoff, general manager; R. M. Douglass, superintendent; Frank J. Suda, assistant auditor; Frank J. Duffy, paymaster, St. Louis Transit Company.

Syracuse, N. Y.—Edward G. Connette, vice-president and general manager Syracuse Rapid Transit Company.

Terre Haute, Ind.—G. C. Tripp, treasurer; M. C. George, electrician; B. N. Grosvenor, master mechanic, Terre Haute Electric Company.

Topeka, Kan.—Clifford C. Baker, president and treasurer; J. G. Slonecker, secretary; Charles Blood Smith, director; J. H. McCahan, superintendent of construction; Albert M. Patten, C. W. Hixon, Topeka Railway Company.

Toronto, Ont.—J. M. Smith, general manager; M. Powers, Toronto Railway Company.

Trenton, N. J.—John A. Rigg, vice-president; Peter Hurley, superintendent, Trenton Street Railway Company.

Venice, Ill.—Fred E. Allen, president; E. J. Spencer, secretary, Venice, Madison & Granite City Railway Company.

Washington, D. C.—George H. Harrier, vice-president; William F. Ham, treasurer, Columbia Railway Company.

Waterbury, Conn.—Charles M. Heminway, cashier Connecticut Lighting & Power Company.

Webb City, Mo.—A. H. Rogers, president; E. J. Pratt, electrical superintendent, South West Missouri Electric Railway Company.

Westwood, Mass.—John R. Graham, Norfolk Western Street Railway Company.

Wilkesbarre, Pa.—John A. Rigg, president; T. A. Wright, superintendent, Wilkesbarre & Wyoming Valley Traction Company.

Wilmington, Del.—John A. Rigg, president; A. V. Arrowsmith, director, Wilmington City Railway Company.

Willoughby, Ohio.—Charles W. Wason, president Cleveland, Painesville & Eastern Railroad Company.

Worcester, Mass.—A. H. Stone, treasurer Worcester Consolidated Street Railway Company.

Youngstown, Ohio.—A. A. Anderson, general manager and treasurer Mahoning Valley Railway Company.

Representatives of Companies Not Members of the Association

Belleville, Ill.—Robert Skeen, electrician; B. S. Hume, St. Louis & Belleville Traction Company.

Carrollton, Mo.—Frank V. Crouch, president Carrollton Electric Railway Company.

Cedar Rapids, Ia.—Royal H. Holbrook, chief engineer Cedar Rapids & Marion City Railway Company.

Chicago, Ill.—George B. Henington, Illinois & Rock River Railway Company.

Cleveland, Ohio.—H. B. Isler, William Lintern, Cleveland, Elyria & Western Railway Company.

Detroit, Mich.—J. M. Mulkey, Toledo & Monroe Railway Company.

East St. Louis, Ill.—M. M. Stephens, C., C. & East St. Louis Electric Railroad Company.

Leavenworth, Kan.—C. L. Hughes, cashier Leavenworth Electric Railroad Company.

Lincoln, Neb.—H. C. Hartley, Lincoln Traction Company.

New York, N. Y.—F. W. Toppan, secretary Bay State Traction Company.

Piqua, Ohio.—C. S. Bidwell, general superintendent Miami Valley Railway Company.

Sandy Hill, N. Y.—F. W. Kinmouth, superintendent Glens Falls, Sandy Hill & Fort Edward Street Railroad Company.

San Diego, Cal.—James Restine, chief electrician San Diego Electric Railway Company.

Sedalia, Mo.—W. F. Waller, receiver; D. F. Webster, Sedalia Electric & Railway Company.

Selma, Ala.—W. R. Hall, Selma Street & Suburban Railway Company.

Washington, D. C.—J. Colvin, superintendent Washington, Arlington & Mt. Vernon Railway Company.

Waupaca, Wis.—Irving P. Lord, president Waupaca Electric Light & Railway Company.

Leavenworth, Kan.—O. D. Henry, superintendent; K. K. Chapin, inspector; W. H. Hammond, H. S. de Neefe, Kansas City & Leavenworth Railway Company.

Rockford, Ill.—T. M. Ellis, general manager Rockford Railway, Light & Power Company.

St. Louis, Mo.—J. Boyle Price, purchasing agent St. Louis Transit Company.

EXHIBITS AT THE CONVENTION

THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, of Philadelphia, represented by V. C. Gilpin, exhibited with McGill, Porter & Berg, its Western agents. The central and most interesting feature was an enormous I. T. E. circuit breaker for 5000 amps. at 600 volts, built for the Metropolitan West Side Elevated Railroad, of Chicago. This breaker had a large copper leaf area of contact, but made final break through carbon plates.

THE SPEER CARBON COMPANY, of St. Mary's, Pa., was well represented by its exhibit with McGill, Porter & Berg, its Western agents, and by J. S. Speer.

THE COMPRESSED AIR COMPANY, of New York, occupied a large space at the Convention Hall, and was well represented by H. D. Cooke, president of the company, well assisted by William E. Selleck, general manager of the Western department, and H. A. Hudson, both of Chicago. The company had for distribution a quantity of interesting literature, relating to the use of compressed air for street railway service, and had many inquiries to answer in regard to the operation of compressed air motors in New York, Chicago and Rome, N. Y. It was easy to answer these inquiries very satisfactorily, and much interest was expressed by the delegates present in the new motive power.

GENERAL VIEW OF CONVENTION HALL

THE J. G. BRILL COMPANY, of Philadelphia, occupied one of the large parlors on the mezzanine floor, in which were shown handsome models of the company's several kinds of trucks, photographs of cars and descriptive matter. The company intended, up to within a short period before the convention, to make a regular exhibit, as usual, at the Convention Hall. The works of the company, however, at Philadelphia have been so full, during the past months, with orders from all parts of the world, that it became evident that a set of trucks could only be diverted to Kansas City for exhibition purposes by delaying delivery on some important order. As the managers did not feel like disappointing any customer in this way, they finally decided to exhibit models and photographs only. These answered very well, however, to illustrate the principles underlying the Brill trucks, while the appearance of the latest cars built was fully shown by photographs. Many inquiries were made for John A. Brill, vice-president of the company, and much regret was expressed that he was unable to be present. As stated elsewhere, Mr. Brill was obliged to be in Virginia. The company was well represented, however, by G. Martin Brill, S. M. Curwen, W. H. Heulings, Jr., George M. Haskell and D. B. Dean, the company's Western manager. Mr. Dean has until recently been connected with the Terre Haute Car & Foundry Company, and is well known and popular in the trade.

M'GILL, PORTER & BERG, whose headquarters are in Chicago, had a large exhibit of the various lines which they handle in common with some of the companies for which they are agents. I. T. E. circuit breakers, National car heaters, Speer carbons, Morris rail bonds, Morris hydraulic splicing press, Woods patent car gate, New Haven car registers, Hunter car signs, Syracuse changeable headlights, Orient incandescent lamps, Monarch paint and M. P. & B. trolley wheels, rope, insulating tape, trolley harps and trolley wheel bushings were among the numerous things filling their large exhibit space. These people distributed a crop of butterflies that stuck wherever they lit, and created quite a sensation opening morning. This enterprising Chicago firm is doing a fine business in its territory, as was shown by the crowd of visitors always found at its headquarters, and the menu it offered its customers was an original piece of work. Max A. Berg and E. R. Mason, of Chicago, were in charge.

THE STAR BRASS WORKS, of Kalamazoo, Mich., had an able and well known representative in the person of George E. Pratt, now its Eastern representative at Philadelphia. It also had a finely arranged exhibit of Kalamazoo trolley wheels and harps. These wheels are cast of pure copper by a patent process, and are softer than the wire, though tough and ductile. They have a grease chamber around the graphite bushing, which does away with the

necessity of oiling, except at infrequent intervals. Records of various wheels were shown, one 6-in. wheel running 35,000 miles, and one 4-in. wheel running 23,000 miles. The factory is now very much crowded, being 18,000 trolley wheels behind orders.

CHISHOLM & MOORE MANUFACTURING COMPANY, Cleveland, Ohio, maker of the American standard rail-joint, exhibited samples of this well known and tried boltless joint, under charge of W. E. Ludlow, one of the directors of the company. This company is also one of the prominent makers of chain hoists, traveling cranes and pneumatic tools, of which Mr. Ludlow had a number of photographs to show to those interested.

HEADQUARTERS OF THE STREET RAILWAY JOURNAL

THE INTERNATIONAL REGISTER COMPANY, of Chicago, exhibited its well known stationary and portable fare registers, also a new type double register, having separate trip registers, as well as totalizers, and operated by a single rod. The mechanism of this machine is constructed almost wholly of cold rolled steel, no cast iron parts whatever being used. The striking feature of this machine is the very large, distinct trip figures, which make it especially desirable for long cars, now so generally coming into use. The aluminum dials first introduced by this company, are now recognized as the best material for register dials. The representatives report the factory filled up with orders for several months ahead, and the prospects for new business better than ever. They were represented by A. H. Woodward, president; W. H. Brown, secretary and treasurer, and Charles E. Pratt, superintendent.

THE GRIFFIN WHEEL COMPANY, Chicago, had a large central space, in which it exhibited a number of different types of wheels and axles. This company has made axles for several years,

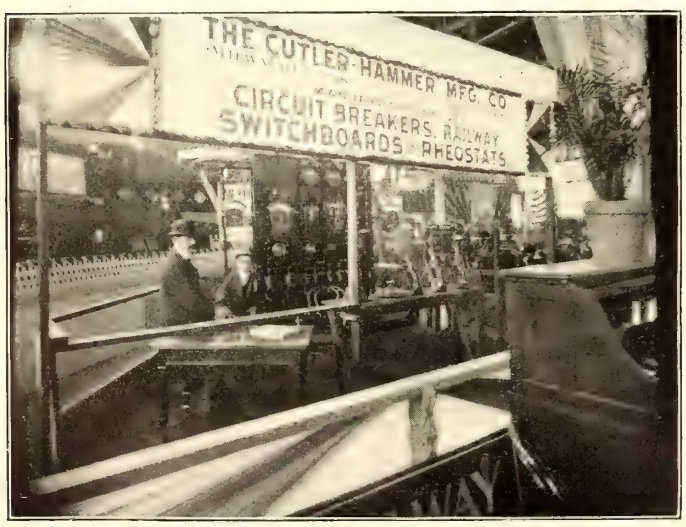


EXHIBIT OF THE CUTLER-HAMMER MANUFACTURING CO.

but through its representatives called special attention to that fact this year. The exhibit consisted of three pairs of 33-in. wheels on axles, one 36-in., curved arm standard pattern, one 33-in. reverse dish wheel, one 33-in. double plate wheel, with 2⅝-in. tread for heavy interurban work, two 30-in. wheels with 2¼-in. tread, one 22-in. pony wheel for maximum traction trucks, with 3-in. tread, one 18-in., and one 18-in. pony wheel, and a number of chilled test pieces. C. K. Knickerbocker and George D. Casgrain represented the company. The company's Kansas City foundry was also a practical exhibit for those of the delegates who visited it.

THE KNELL AIR BRAKE COMPANY, of Battle Creek, Mich., which has recently become a successful competitor in the street railway air brake field, was represented by Anthony H. Metzelaar, general manager, and R. F. Hoffmaster, treasurer. The exhibit consisted of this company's geared axle-driven air compressor, with cylinder, 4-in. diameter by 7½-in. stroke, and auxiliary air brake appliances. This compressor is winning its way through its simplicity, which is a subject of much favorable comment. The compressor is driven by a center crank, the crank being driven by a pair of gears from the axle at a slower speed than the axle itself. The pinion on the axle is split, so that it can be put on and taken off without disturbing the wheels. The system has an automatic cut-off, which lets the compressor discharge into the air whenever the air pressure reaches the amount for which the cut-off is set. This company puts on a compressor of such a size that most of the air is pumped while the car is coming to a stop after the brakes are applied, thus utilizing waste energy.

THE MORRIS ELECTRIC COMPANY, of New York, with Elmer P. Morris as representative, exhibited with McGill, Porter & Berg, its Western agents. National car heaters and Morris rail bonds are among the better known goods. A hydraulic press for compressing a copper sleeve to make a sleeve joint between wires was one of the novelties. The Wood patent car gate and Hunter car sign were also shown, together with Morris car trimmings and bell rope.

THE H. W. JOHNS MANUFACTURING COMPANY, New York, had a very interesting exhibit to the progressive electrical man, especially in the way of fuses and heaters. The Sachs enclosed Noark fuses, which have a chemical filling which becomes an insulator when the fuse blows, and destroys the arc, were shown for amperages from 250 milliamperes to 600 amps. in a single tube, for low voltages, and for from 110 volts to 20,000 volts. These fuses all have an indicating fine wire shunt on the outside to show whether the fuse is blown or not. Other electrical goods of interest shown by this company were vulcabeston for controller guards, brush holders and other places requiring heat resistance in an insulator, electric heaters, overhead mica molded insulators, Philadelphia type, section insulators. The newest product shown was an Edison fuse plug, provided with a Sachs enclosed fuse, the fuse part being easily replaceable without destroying the plug. Enclosed fuse car cut-outs in 200-amp. and 400-amp. sizes were prominent. This company reports a big rush in all departments, type C panel heaters being especially in great demand. A. Hall Berry, manager electrical department; Joseph Sachs, engineer; D. T. Dickson, Philadelphia branch; J. W. Perry, Philadelphia; H. D. Bayne, Pittsburgh, and S. H. Finney and W. R. Kendall, of the Manville Covering Company, Western agents, were present.

THE MERCANTILE LUMBER & SUPPLY COMPANY, of Kansas City, whose exhibit was in charge of H. W. Jacques, manager, and W. W. Graham, sales agent, makes a specialty of finishing wood poles and ties, but is also agent for the Carborundum Company, of Niagara Falls, N. Y.; the Star Headlight Company, of Syracuse, N. Y., and the Streeter Brake-Shoe Company, of Chicago, all of whose products were shown.

THE STREETER BRAKE-SHOE COMPANY, of Chicago, was represented by George W. Evans, Eastern sales agent, who had an exhibit with the Kansas City agent, the Mercantile Lumber & Supply Company.

THE STAR HEADLIGHT COMPANY, of Utica, N. Y., was represented by its Kansas City agent, the Mercantile Lumber & Supply Company, which had an exhibit.

THE TAYLOR ELECTRIC TRUCK COMPANY, Troy, N. Y., was unfortunate in not being able to get the wheels for its truck exhibit in time, but had a fine display of truck frames, nevertheless. John Taylor, manager of the company, was in charge, assisted by Robert N. Kasson. All the trucks embodied recent improvements for supporting extra long and heavy cars. An 8-ft. wheel base, single truck, a set of Empire State radial trucks, a set of the company's regular swing motion double trucks, a set of extra heavy trucks of the same pattern, especially designed for heavy service and high speeds, attracted favorable comment from visiting master mechanics.

THE M'GUIRE MANUFACTURING COMPANY, Chicago, placed one of its combination snow plow and sweepers just across the street from the convention hall, and it was one of the first familiar objects to greet the eye of the delegate. Inside the hall the company had its new double truck No. 39, adopted by the Chicago Union Traction Company for long cars. It is very simple, having a four-part steel frame and locomotive finish. It had also on the floor a maximum traction truck, and a Columbian single truck, and in the Westinghouse exhibit a Pittsburgh type single truck, equipped with motors. In addition to trucks and sweeper the company, of course, showed its Royal Flush fender, New Columbian car heater and elastic brake hanger. Vice-President W. J. Cooke, who never misses a convention, and T. J. Callinan were in charge of the exhibit. Mr. Cooke distributed a neat aluminum cover memorandum tablet, showing a McGuire double truck in relief on the back cover.

THE CONSOLIDATED CAR HEATING COMPANY, Albany, N. Y., had its Chicago representative, W. P. Cosper, in attendance, and also Cornell S. Hawley, New York, and William H. Fulton, mechanical inspector, Albany. The exhibit comprised heaters suitable for all forms of standard and special street car seats, including the regular panel heater for side seats, and a twelve-heater equipment for a 25-ft. cross-seat car. Special attention was called to the fact that the heat is distributed over the entire length of the heater on all three points of the controlling switch, and this was illustrated by lamps placed in the heaters. The United Traction Company, of Albany, loaned a heater from a six-heater equipment for this exhibit that had been in use eight years, from 1892 to 1900, and was in perfect condition, the coils retaining their shape, and with but a very thin coating of oxide formed on the wire.

SOME IMPORTANT EXHIBITS

THE NATIONAL LEAD COMPANY, makers of "Phœnix" babbitt metal and National Lead Company warranted half and half solder, had a handsomely arranged booth and a large corps of representatives. Walter H. Baker, J. C. Younglove, George T. Faxon, J. R. Boyd, Arthur Benzel and George E. O'Neil were present. A large bell of Phœnix babbitt metal was mounted at one end of this company's space, and occasionally sent forth a considerable volume of sound. "Collier," "Southern" and "Red Seal" brands of pure old Dutch process white lead were also among this company's famous products exhibited.

THE WHEEL TRUING BRAKE-SHOE COMPANY, of Detroit, Mich., exhibited its brake-shoe in charge of J. M. Griffin, president. This shoe is simply an iron frame of the same form as

a brake-shoe, filled with an abrasive composition. The shoe is put on in place of the ordinary iron shoe whenever a flat wheel occurs, and is kept in service until the flat spot has been ground off. Over 200 roads use this shoe, including the Boston Elevated, Milwaukee Electric Railway, Denver Tramway and the principal roads at San Francisco, Washington and Kansas City. It seems to have solved the flat wheel problem for the roads using it, and now that the difficulty originally experienced in securing a suitable abrasive composition has been overcome, the factory is running night and day to fill orders.

J. R. M'CARDELL & COMPANY, of Trenton, N. J., had on exhibition one of their tower wagons, built for the St. Louis Transit Company. The wagon was in charge of J. R. McCardell, who exhibited to the delegates present the ease with which the working platform can be raised and lowered, and set at any position desired.

EXHIBIT OF THE PECKHAM TRUCK CO.

EXHIBIT OF THE B. & R. ELECTRIC CO.

EXHIBIT OF THE STANDARD UNDERGROUND CABLE CO.

EXHIBIT OF THE CHRISTENSEN ENGINEERING CO.

THE GOLD STREET CAR HEATING COMPANY, of New York, had an attractive booth, in which was exhibited a full line of its electric heaters, principally for street railway service, but also including a number of designs for waiting rooms and other buildings. The special feature of the exhibit, and one which attracted much attention, was a new type of heater with wrought iron casing. This heater embodies all of the interior constructive features of the old heater, but the exterior case is quite novel. It is made of No. 14 sheet iron, reducing in this way the weight of a car equipment at least 100 lbs. over the old cast-iron equipment. The importance of this saving in weight to a railway company can easily be estimated. The use of this material also makes a very attractive case, in fact one more ornamental than the older cast-iron form. The company also showed a new three-point switch, capable of carrying and breaking 35 amps. at 500 volts. A novel feature of this switch is that it can be turned in either direction. This saves unnecessary wear on the points, as the handle can be turned backward through one point to reduce the heat, instead of turning it continuously in a forward direction through zero to accomplish the same result. The company was ably represented by James Watson, John E. Ward and E. H. Gold.

MUCH REGRET was expressed at the absence of John A. Brill, who has always been a regular attendant of former conventions. Mr. Brill has not been in very good health, and is spending a few weeks at Hot Springs, Va.

F. W. DARLINGTON, president of the Darlington Electric Fountain & Supply Company, of Philadelphia, was present at the convention, and had some circulars relating to his electric fountains. The circular contained an illustration of the fountain installed at Willow Grove Park, at Philadelphia, by Mr. Darlington.

THE PENNSYLVANIA STEEL COMPANY made no exhibit, but was represented by Charles S. Clark, of Boston; Mason D. Pratt and C. W. Reinoehl, of Steelton; F. W. Edmunds, of Chicago, and J. G. Miller, of St. Louis.

J. H. STEDMAN, of Rochester, was a prominent and popular attendant at the convention, and with an extra number of good stories. He also did some good business in his transfer tickets.

THE JOHN A. ROEBLING'S SONS COMPANY, of Trenton, N. J., had no exhibit, but the able representation by Marston R. Cockey, of New York; G. W. Swan, of New York, and U. G. Tingley, of Trenton, N. J., together with the reputation of the company, made an exhibit unnecessary.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, of Cincinnati, exhibited its new slow-starting controller handle in the Ridlon Company's space. P. F. Harten looked after the device, and explained it to possible customers. It is a controller handle working on the principle of a ratchet, and allowing the motorman to go only one notch at a time.

THE FRANK RIDLON COMPANY, 200 Summer Street, Boston, was represented by its popular vice-president, Charles N. Wood. The Wilson trolley catcher, of which about 7000 are in

use, was a center of interest. The Kilbourn track sanding device and the slow-starting controller handle of the Electric Railway Equipment Company, of Cincinnati, as well as the Conant rail-bond testing device for testing rail-bond conductivity in terms of rail lengths by the Wheatstone bridge and telephone receiver method, were other leading features, besides which was the Beverly vestibule brake handle. P. F. Harten, of the Electric Railway Equipment Company, of Cincinnati, was also in attendance at this booth, in the interests of the controller handle.

THE GARTON-DANIELS COMPANY, of Keokuk, Ia., showed the "Automotoneer," in a perfected form, applied to a type K controller. This device enforces a pause on each notch of a controller, and may be adjusted to allow the starting of a car in seven, ten or twelve seconds, as may be desired. It will effect a reduction in maximum demand for current, and will save repair bills and accidents, as it requires the proper handling of the controller. In an emergency stop, where the motors are to be reversed, this device prevents the motorman throwing the handle too far, which almost invariably throws the circuit-breaker, or burns out a fuse, so that the operator loses control of his car. Much interest was shown in this device. This company also exhibited a full line of its standard lightning arresters, which have attained such a remarkable record. A station panel, carrying three 600-amp. kicking-coils and three arresters, was also shown. A telephone extension ringer, that is being placed on the market by the Garton-Daniels Company, attracted considerable attention, as it differs from others on the market in being self-restoring. The company was represented by J. V. E. Titus, secretary, and V. J. Van Horn.

THE G. P. MAGANN AIR BRAKE COMPANY, of Detroit, Mich., represented by its manager, E. C. Rutherford, presented a very tastefully arranged booth in the convention hall, using principally as its exhibit for this convention the cars on the Kansas City-Leavenworth Railway, on which lines its brakes have been in operation for the past year, and which have given the greatest satisfaction. By the kindness of the Kansas City-Leavenworth road, verbal invitations were issued to members of the American Street Railway Association for a trip over the road, and a great many availed themselves of this opportunity of examining the G. P. Magann Storage Air Brake System, which has been so much to the front for the past several years.

THE KINNEAR MANUFACTURING COMPANY, of Columbus, Ohio, represented by F. C. Schmidt, secretary, had a sample of its rolling car house door on exhibition. This sample showed the special trolley arrangement employed by this company for presenting a continuous surface to the trolley wheel. Among the photographs of doors installed the one of a door 36 ft. wide and 20 ft. high attracted unusual notice.

THE LEA ELECTRIC MANUFACTURING COMPANY, of Elwood, Ind., had an exhibit of Lea inclosed arc lamps, with W. M. Porter, general sales agent, in charge. The feature of this exhibit that attracted most attention from street railway men was the arc headlight.

THE CREAGHEAD ENGINEERING COMPANY, Cincinnati, made its usual extensive exhibit of overhead line material, flexible brackets, malleable iron fittings for iron and wood poles, cross arms, mallcable pins, etc. Its exhibit was tastefully arranged, and a series of large photographs showed its material in use in all parts of the world. G. R. Scrugham, superintendent of the company, was in charge.

EXHIBITS OF CONTINUOUS RAIL JOINT CO., STANDARD PAINT CO. AND HAROLD P. BROWN

THE BIERBAUM & MERRICK METAL COMPANY, Buffalo, N. Y., had a handsome little display of "Lumen" bronze bearings and trolley wheels. The trolley wheels of this company have soft steel flanges and copper bearing grooves. E. P. Sharp, manager street railway department, was present.

THE PARROTT VARNISH COMPANY, though not an exhibitor, sent its St. Louis railway representative, R. E. Mills, 610 Holland Building. This company does a large business in car varnishes.

THE HAM SAND BOX COMPANY, of Troy, N. Y., was represented by R. H. and A. W. Ham, who showed the company's new spiral spring steel hose, which can be put at any angle without buckling. Snow or ice that may gather therein are easily removed by pulling the spring down to the track or rail, and quickly letting it go. This is a feature peculiar to the Ham sand box. The company also showed three of its latest boxes, Nos. 5, 6 and 7, and demonstrated their practical use. The company is doing an enormous business abroad; during the past eighteen months it has shipped, among others, 1290 boxes to the Glasgow Corporation Tramways, 4000 to the Electric Railway & Tramway Carriage Works, Preston, England; 100 boxes to E. H. Cadiot & Company, Paris; 160 boxes to the Gloucester Railway Carriage & Wagon Company, etc. Among the other big roads ordering these boxes during the past year in America are the Brooklyn Heights Railroad Company, 700, and the American Railways Company, 100. The various car builders have used, within the past year, over 1500 boxes.

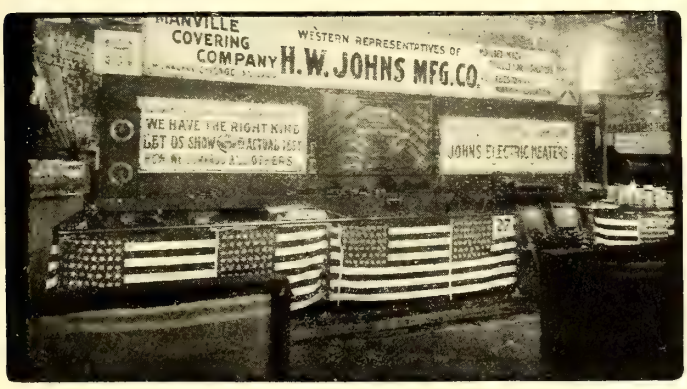


EXHIBIT OF THE H. W. JOHNS MANUFACTURING CO.

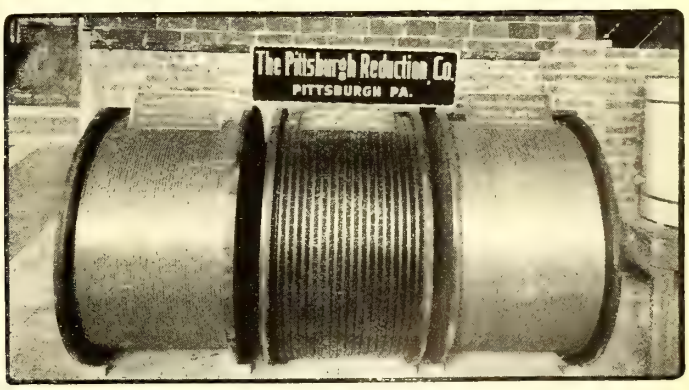


EXHIBIT OF THE PITTSBURGH REDUCTION CO.

THE BETHLEHEM STEEL COMPANY, which, at the meeting of the association in St. Louis, exhibited a large hollow-forged steel shaft, that is now one of several operating the power plant of the Northwestern Elevated Railroad in Chicago, and which, last year, at the Chicago meeting, had an exhibit of hollow-forged steel shafts operating almost every power plant in that city, called attention to the fact that Kansas City is not behind in progressiveness, by pointing to the hollow shafts in the Kaw River power house. It has been said that the enormous units now installed in the power plants of the Metropolitan Traction Company and the proposed stations of the Manhattan Elevated Railroad in New York City, and the Boston Elevated Railroad in Boston, are made possible by the use of this type of shaft. By no other method of manufacture could a shaft be made that would be sufficiently strong and light. H. F. J. Porter, who represented the company, showed not only to the members of the association, but to many of the supply men, who are manufacturers, steel chips which have been cut from castings and forgings at his works at speeds which seem to be incomprehensible. Some of these chips have been cut at a speed which would be attained in turning wood. The introduction into shops of the tool steel which does this work is destined to revolutionize not only the machine tool industry, but machine shop practice as well.

THE MAYER & ENGLUND COMPANY, of Philadelphia, Pittsburgh and New York, were represented by C. J. Mayer, William A. Armstrong, Jr., and H. G. Lewis. These gentlemen had many friends at the convention, and all users, of whom there were many, spoke in the highest terms of the apparatus supplied by them.

THE WALWORTH MANUFACTURING COMPANY, of Boston, was represented by Herbert L. Rideout. This company is a well known manufacturer of brass and iron goods and piping tools. The articles on exhibition were high-pressure gate valves and special blow-off cocks, also the Van Stone joint, a well approved method of applying flanges to pipe for high service. The exhibit also included a steam and air whistle. The Walworth Manufacturing Company is a big contractor for installing power house piping, as the many street railway contracts carried out by the company testify. The company also manufactures the Walworth "Klingfast" pipe vise and the Walworth vise, the Ashley patent right and left nipple holder, Walworth die plates, Miller's patent reversible ratchet die plates, Smith's patent friction drill stocks, and the Stillson adjustable pipe wrench.

F. H. NEWCOMB, of Brooklyn, N. Y., the well known maker of uniform caps, showed a full line of caps, which the company

VIEWS TAKEN AROUND CONVENTION HALL

claims are in use by 50 per cent of the roads in this country. In addition to the work in this country, Mr. Newcomb says that he is preparing to reach tramways abroad, as letters show that these

EXHIBIT OF THE NEW HAVEN CAR REGISTER CO.

goods can be supplied from America to advantage. Mr. Newcomb gave out as a souvenir a dating stamp, good for six years, and showing a New York Central & Hudson River Railroad conductor's cap.

FISKE BROTHERS REFINING COMPANY, of New York, the well known makers of "Lubroleine," were represented by E. H. Chapin, who very ably looked after the interests of his company. Mr. Chapin was, as usual, one of the most popular representatives, owing to his ready wit and his quick repartee. Mr. Chapin gave out as a souvenir a very pretty little mirror, with celluloid back, and a pin cushion around the edges.

EXHIBIT OF THE CURTAIN SUPPLY CO.

THE STANDARD PAINT COMPANY, of New York, had an attractive space, in which were shown "P. & B." electrical compounds, paints, waterproof insulating tapes, armature varnish, insulating papers, motor cloth and ruberoid roofing. The company gave as a souvenir a very nice, useful combination blotter pad, and was well represented by J. C. Shainwald, Western manager, and by J. F. Hicks, of Chicago.

THE HALE & KILBURN COMPANY, of Philadelphia, was represented by its Western manager, H. T. Bigelow, of Chicago. The company showed a large number of seats, including the "walk over" seats, upholstered in various materials, also longitudinal seating, with combination construction. The seats, with patented grab handles, attracted much attention.

WILLIAM WHARTON, JR., & COMPANY, Incorporated, of Philadelphia, had, as usual, an attractive booth at the convention, filled with the latest improvements in track work. The company was represented by Victor Angerer, of Philadelphia, and J. C. Robinson, of Boston. Although the company manufactures all kinds of special track work for street railways and steam railroads as well, particular stress was evidently laid in the exhibit on its manganese steel special work, which is growing more and more in favor, on account of its phenomenal wearing qualities. Examples of this wear were exhibited in the shape of a wornout frog, which had sustained the traffic of 1,657,000 cars on a curve of 44-ft. radius, the head of the rail having been almost entirely worn away, while the manganese steel center of the frog is still in fair condition. The manganese steel center of another frog was also exhibited, which had 2,570,000 cars over it on a straight run, and it is remarkable how comparatively little wear it showed. Samples of the company's standard manganese steel center girder rail work, and also solid manganese steel work for T-rail track were shown, besides the well known Wharton unbroken main line switch and the Nichols protected heel switch, which is attracting considerable attention among street railway men. The ductility of the manganese steel is demonstrated in the shape of bent pieces of that remarkable metal, and the solidity of this work was shown by sections through the body of the pieces as they are cast together in the method of their manufacture. The whole exhibit was made especially attractive through its arrangement, and through the exhibition of numerous and large photographs, showing the company's works, also some remarkable special work layouts, as put together in the yard, blue prints of the company's working plans, etc.

THE DUFF MANUFACTURING COMPANY, of Allegheny, Pa., was represented by J. Barrett, manager and vice-president. The company exhibited a full line of lever, track and oil-well jacks.

THE JOSEPH DIXON CRUCIBLE COMPANY, of Jersey City, N. J., which makes such a variety of graphite products, suitable for electric railways, had a full representation, both in men and products. Sam Mayer and Dudley A. Johnson, of the Chicago branch; Wm. B. Allen and E. A. St. John, Western salesmen, and A. L. Haasis, Eastern salesman, made it pleasant for visitors. Graphite resistance rods, graphite for dash-pots, graphite brushes, filament winders (on which incandescent lamp filaments are baked), graphited wood grease for stopping noise of gears, and at the same time affording a lubricant that will not ooze out of the gear casing, graphite curve grease, dynamo lubricating graphite, graphite commutator dressing, graphite motor brushes and graphite paint for trolley poles were all included in the exhibit. A souvenir pencil, with puzzle attachment for the button hole, afforded food for reflection by the studiously inclined.

THE GARL ELECTRIC COMPANY, of Akron, Ohio, had a display of especial interest to interurban roads. This company has a block signal system for single-track roads which can be used either as a visual or audible signal—when the latter, a blank cartridge explodes in the signal box whenever two cars approach each other within a mile. Combined with this block system is a portable telephone, which can be used for communication with the main office over the signal wires. The main office can also signal a train to stop at any signal in case of a change of time. This company makes a sectional fish pole for telephone connection from the ground to a telephone line wire, or pair of wires, anywhere along the line. Intercommunicating telephone sets and automatic fire alarms completed the exhibit. Max Schumacher,

EXHIBIT OF WM. WHARTON, JR., & CO.

secretary and treasurer, and M. Garl, superintendent, were in attendance.

HANNA & GRAY, of Chicago, attended the convention as representatives of the Peckham Truck Company, Jewett Car Company and the St. Louis Car Wheel Company. The firm was represented by both Mr. Hanna and Mr. Gray, and had many compliments for the most elaborate souvenir given at the convention. This was a very elaborate reference and report book for railway officials, and was compiled through the courtesy and with the assistance of prominent members of the Street Railway Accountants' Association of America. The book consists of many pages, printed on thin bond paper, and ruled off with spaces for entering the principal data and records of street railway operation. Space is left for similar data of succeeding years, so that five to ten or more years' operation can be compared. The book is arranged in three parts, or main divisions. The first main division is the "Condensed Comparative Yearly Report for Twenty-one Years." This report has ten main headings and fifty-one sub-headings, by years, for twenty-one years. The second main division is the "Yearly Table of Operating Expenses for Five Years." This shows each operating expense account by years, for five years, through eight different propositions. The third main division is the "Monthly Report for Five Years." This report has twenty-four main headings, and 180 sub-headings, showing the details by months, total for six months, increase or decrease for six months, total for one year, and increase or decrease for one year, for five years. The table of contents is arranged to conform to the arrangement of the book and not indexed alphabetically. The books were bound in leather in two ways, one for pocket and one for desk use. The value of it to the practical railway manager is shown by the fact that President Duffy, of the Accountants' Association, referred to it in most commendatory terms in his annual address to the association, as being a most creditable undertaking. In spite of the evidently high cost of producing this book, Mr. Hanna stated that his firm did not intend to ask payment for it, but had them made exclusively for presentation to railway officials interested. In addition to this book the company had on exhibition in a parlor of the Midland Hotel some handsome models of Peckham trucks, a sample St. Louis car wheel and some attractive photographs of Jewett cars.

THE CHRISTENSEN ENGINEERING COMPANY, of Milwaukee, had a very large exhibit, all of it operative, and showing the apparatus working. The quick-acting air brake and automatic compressor equipment, which is going on each car of the Boston Elevated (multiple unit system) was shown, and also a school equipment (for teaching the action of the brake), consisting of a double-truck car equipment for city and suburban service, with independent motor compressor. There was also a compressing apparatus, together with air hoist and air jacks for handling motors under trucks, etc. N. A. Christensen, G. S. Hastings, F. C. Randall, W. J. Richards, J. S. Hamlin, J. S. Leet, J. R. Sutton and A. Beveridge comprised this company's convention force.

THE STANDARD UNDERGROUND CABLE COMPANY had on exhibition the four large, handsome cabinets of samples which attracted much attention at the National Export Exposition at Philadelphia, and for which that company received medal and blue ribbon as being the most complete exhibition of its kind ever seen. There was shown in that display everything that is made in the way of wires and cables, together with all the accessories and appurtenances that enter into the underground and overhead construction work as installed by the company. Being pioneers in underground cable work in America, their present methods are the result of years of experience and experiment. J. R. Wiley, of Chicago, Western manager, one of the best known electrical men of the West, most ably looked after the company's interests at the convention.

THE OHIO BRASS COMPANY'S exhibit was particularly artistic and complete. A large variety of flexible pole brackets were shown for both iron and wood poles. There probably has never been a more complete exhibit of line material presented at any convention. There were many novelties of design, including a new 3-in. globe strain insulator, a giant double Brooklyn strain insulator and a number of forms of round top hangers, among which the new type N attracted the most attention, because of neatness, compactness and strength. As usual, the company presented a large variety of fixtures for figure 8 wire, and was prepared with late designs for the new grooved wire. Special interest was shown in twin hangers for double trolley wire, both type D and cap and cone forms. A new third-rail insulator permitted fractions of movement of the rail up and down to prevent breaking of the insulators, while perfectly supporting the rail. O. B. bell metal bearings for armature work, in which the concern takes particular pride, and line section switches and track brush holders were leading features. The Monarch track scraper and emergency hose bridge were shown in a separate space. C. K. King, secretary; R. A. Byrns, manager New York office; George O. Mead, engineer, and A. L. Wilkinson, were present.

THE R. D. NUTTALL COMPANY, of Pittsburgh, Pa., manufacturers of Nuttall's gears and pinions, Union standard trolleys, etc., was represented by F. A. Estep, president, and by C. J. Mayer and William A. Armstrong, of Mayer & Englund Company, of Philadelphia; Charles N. Wood, of Boston; Garson Myers, of Chicago, and by the B. & R. Electric Company, of Kansas City, Mo. The company had a good-sized exhibit on the east gallery. The exhibit attracted wide attention and the representatives present were as well known and popular as any at the convention.

EUGENE MUNSELL & COMPANY AND THE MICA INSULATOR COMPANY, of New York, Chicago and London, were represented by Charles E. Coleman, manager of the Chicago house. Mr. Coleman distributed a very handsome leather bill folder, together with a medal similar to the gold medal awarded the Mica Insulator Company at Paris.

WENDELL & MacDUFFIE, of New York, were represented by both members of the firm, who were passengers on the New York special, and made their headquarters at the Midland Hotel, where all callers were liberally entertained.

THE AMERICAN IMPROVED RAIL-JOINT COMPANY, of Chicago, was represented by President A. S. Littlefield and D. J. Evans, secretary of the company. This company has done a large amount of work in Kansas City, and reports a satisfactory business for the year.

THE MULTIPLEX REFLECTOR COMPANY, of Cleveland, made an exhibition of its new headlights through its Chicago agent, the W. R. Garton Company.

THE ST. LOUIS CAR WHEEL COMPANY, of St. Louis, showed some of its special type of car wheels. The samples shown had a deep chill, very strong spokes and heavy flange, and are claimed to be making new mileage records.

THE STERLING-MEAKER COMPANY, of New York, was represented by its treasurer, E. F. Wickwire.

COL. E. J. SPENCER, of St. Louis, secretary of the Venice, Madison & Kansas City Railway, was at the convention, accompanied by Mrs. Spencer.

THE MERRITT ELECTRIC AIR BRAKE COMPANY, 22 Broad Street, New York, exhibited its air compressor controlling switch.

HUFF'S STREET RAILWAY SWEEPER was shown at the convention in the form of a model, which attracted considerable attention.

THE ATLAS RAILWAY SUPPLY COMPANY, of Chicago, exhibited its joints for T-rails, and various forms of girder, and also samples of its surfacer and primer for railway cars. The representatives expressed themselves as well pleased with the attention their goods received. J. G. McMichael, president; R. B. Kent, superintendent, and E. W. Ash were the gentlemen present from this company.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, was represented by its genial general salesman, Frank G. Bolles, who distributed some unique souvenirs, which were as much or more sought after than any at the convention.

COLONEL GILES S. ALLISON, New York, made an exhibit of the new self-recording register made by the St. Louis Register Company, the Cael car door fixture, and models of Tripartite steel poles. Colonel Allison also represented the street railway department of Valentine & Co., New York; and also the sales department of the Brooklyn Heights Railroad Company.

THE RAND AVERY SUPPLY COMPANY, of Boston, was represented by its secretary, James F. Wattles, whose souvenir was in great demand.

THE SPEER CARBON COMPANY, of St. Marys, Pa., showed a very complete line of its well known carbon brushes. The company was represented by Manager Speer, who reports that the large new plant of the company is running day and night exclusively on brush work.

LYTLE J. HUNTER, of the Hunter Illuminated Car Sign Company, Cincinnati, was there as usual. A sample revolving sign attracted the attention of every street railway man that saw it. This type of sign was first exhibited at the St. Louis convention, and

since then it has become the standard on quite a large number of roads. The company was also represented by E. L. Hawkins, who was well pleased over his first convention work.

THE TRIPARTITE STEEL POLE COMPANY, of New York, was represented by Col. Giles S. Allison, the general sales agent of the company. This new type of sectional pole, in which there are no bolts or rivets, was favorably commented on by the majority of those who saw the model which the Colonel exhibited.

LOUIS E. MYERS, Chicago, entertained his friends at Suite K, Midland Hotel. On Wednesday and Thursday Mr. Myers conducted parties of interested street railway men on inspection trips to various pieces of track work installed by him.

THE NEW HAVEN CAR REGISTER COMPANY had a very large and attractive exhibit at the front of the west gallery. All the officers of the company were present, as follows: Willis M. Anthony, president; F. Coleman Boyd, vice-president and general manager; John S. Bradley, secretary and treasurer; also H. E. Beach, representative. The company showed a full line of its well known single, double and triple square registers, and also its new single and double registers, which were a marked feature of its exhibit. A new machine was a double register for co-operative use by two companies operating the same car over two roads. One half of the register is locked when the other half is in use, so that there is no chance for confusion. Another special register shown had an independent reset for tickets and cash fares to suit peculiar conditions on some roads. Other special registers are also made by this company, to meet the requirements of special conditions. This company makes the only triple machine on the market, and a sample of this was shown in operation. This machine is operated by one rod and one set of cord fixtures. The bells are different for each class. The registers show registered number of trips as well as direction, which feature detects any attempt a conductor might make to tamper with the machines. The company took great pride in showing a register mechanism put up for use as a counting machine in a factory, where it has registered over 10,900,000 during the past year, or more than it would be called on to register in 100 years' street railway service. The condition of this machine demonstrated that there is practically no wear out to the New Haven fare register in practice. The company also made a full display of its line of supplies, consisting of register rods, and rod and cord fixtures, leather and woven bell and register cords, the New Haven special waterproof trolley cord, conductors' punches and badges of all kinds. The entire exhibit attracted much attention and was one of the best of the convention.

JOSEPH W. CRAMER, of Kansas City, inventor of a car fender designed to be carried close to the track, had a model on exhibition.

THE BAKER-VAWTER COMPANY, Chamber of Commerce, Chicago, maker of loose leaf ledger and account books, had a display of interest to accountants. Its loose leaf systems are a great help to book-keeping, and the accountants showed considerable interest in the forms. C. H. Smalley, Barton T. Bean and Thomas H. Waller were present.

THE METAL SALES COMPANY, Cleveland, Ohio, manufacturer of the renowned anti-friction metal, also niccolite challenge rolling mill metal, had a display of its anti-friction metal for armature bearings, and a sample of its new patent mandrel for pouring armature bearings. F. R. Marks, G. A. Burke and Charles S. Watson were in attendance, and were able to give many practical points to delegates on care and wear of bearings.

THE OHMER CAR REGISTER COMPANY, Dayton, Ohio, had no display at the convention hall, but W. B. Farnaham, treasurer, and J. H. Stedman, secretary, represented the concern.

THE NATIONAL CARBON COMPANY, Cleveland, Ohio, made a small display of its new "Columbia" brushes, dry cells for use on street car signal-bell circuits and high grade carbons for inclosed arc lamps. A pair of brushes were shown which had run three months on a car in Cleveland with but ⅛ in. wear. Henry J. Davies, secretary, was the company's representative at this convention.

THE COLUMBIA MACHINE WORKS, Brooklyn, N. Y., makers of car trimmings, bearings, gear cases, controller parts, fuse boxes, ratchet brake handles and trolley wheels, had a small space, from which W. R. Kerschner distributed a handsome souvenir card-case.

THE FULLER-WARREN COMPANY, Milwaukee, Wis., exhibited its self-feeding car stove under charge of H. B. Dewey, contracting agent.

JOHN T. McROY, Chicago and New York, who has been a regular attendant at street railway conventions for some years, was on hand, as usual, with an exhibit of vitrified conduit in long lengths.

THe SYRACUSE CHANGEABLE ELECTRIC HEADLIGHTS, manufactured by the Crouse-Hinds Electric Company, of Syracuse, were shown by McGill, Porter and Berg, of Chicago.

THE DUNLAP ELECTRIC ILLUMINATED FOUNTAIN in Heim Park, built by C. A. Dunlap, of Providence, R. I., was inspected by quite a number of visitors.

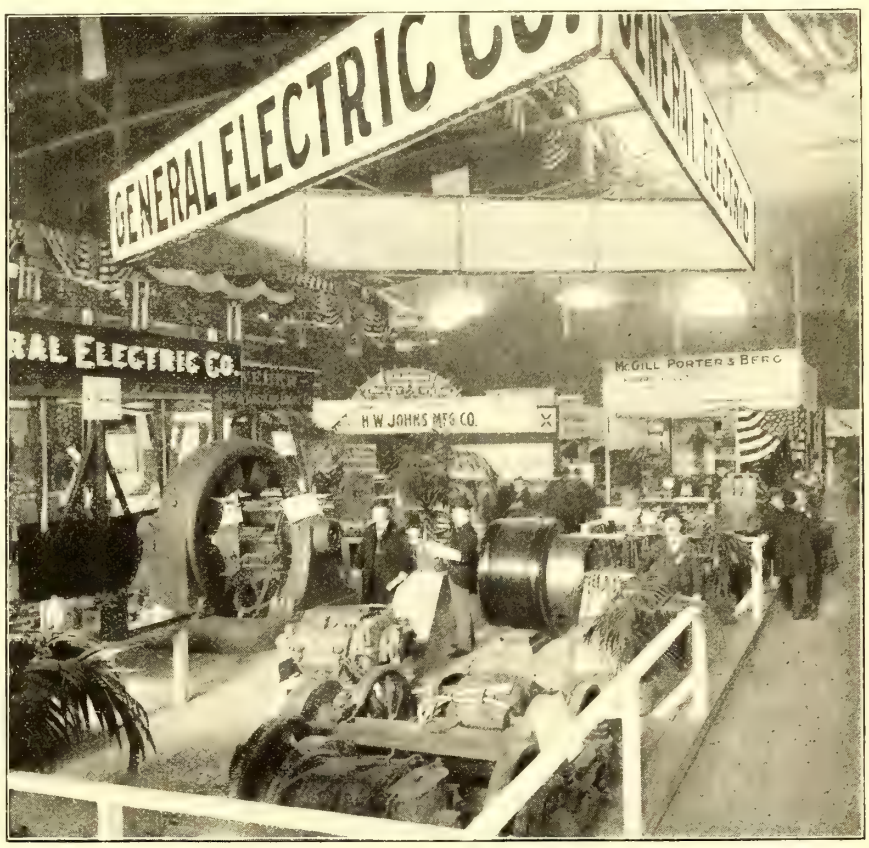


EXHIBIT OF THE GENERAL ELECTRIC CO.

THE JEWETT CAR COMPANY, Jewett, Ohio, was represented by Hanna & Gray, of Chicago.

GEN. OTTO H. FALK, vice-president of the Falk Company, of Milwaukee, made his first appearance at a street railway convention, but was very much in evidence and made a great many friends.

ROSSITER, MacGOVERN & CO., New York, entertained its friends in its headquarters at the Midland Hotel. Frank MacGovern, who has been making an extensive trip in Europe, returned in time to reach the convention. The company was also represented by J. A. Stewart.

COLONEL A. C. WOODWORTH, manager of the Consolidated Car Fender Company, of Providence, was one of the passengers on the New York special. While this company's exhibits have heretofore been a feature at the conventions, the company made no exhibt this year, but expects to make an extra fine one in New York.

THE NEW PROCESS RAWHIDE COMPANY, of Syracuse, made no exhibit, but was represented by that genial good fellow, A. C. Vosburg.

THE BROWNELL CAR COMPANY, of St. Louis, Mo., had its interests looked after by its president, F. B. Brownell. The special private car built by this company, which was running on the streets of Kansas City for the conveyance of special parties, was a magnificent piece of workmanship, and was admired by all who were fortunate enough to see it. It was luxuriously fitted up as a parlor car, provided with ice chest, water cooler and everything practicable that could be thought of to add to the comfort of the passengers. While there were no cars exhibited at the hall, this car served as more than a substitute for the Brownell Company.

THE BABCOCK & WILCOX COMPANY, of New York, had W. H. Wells, of Chicago, at the convention.

THE ROCHESTER CAR WHEEL COMPANY, of Rochester, N. Y., made no exhibit, but F. D. Russell and George C. Morse, of Rochester, looked after this company's interests. As a souvenir the company had a pocket rule.

THE AMERICAN ELECTRICAL WORKS, Providence, R. I., were, as usual at Western conventions, represented by F. E. Donahoe of Chicago.

J. G. WHITE & CO., New York, are constructing the Toledo & Monroe Electric Railway from Toledo to Detroit. C. G. Young, who has charge of the construction of this road, was a convention visitor.

THE PRICE BRAKE of the Peckham Truck Company was in regular service on one of the Metropolitan cars, and visitors desiring to see its operation were furnished with its time-table so that

EXHIBIT OF THE JOSEPH DIXON CRUCIBLE CO.

they might catch the car without waste of time. The working of this brake has been highly satisfactory in Kansas City, and was inspected by many of the convention visitors.

GEORGE O. NAGLE, formerly superintendent of the Chicago City Railway, was also a visitor at the convention, meeting old acquaintances.

ADAMS & WESTLAKE, Chicago, made an exhibit in connection with the Curtain Supply Company.

J. M. MULKEY, manager and one of the leading stockholders of the Toledo & Monroe Electric Railway, attended the convention.

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., was represented by Charles Scudder, jr.

THE FUEL ECONOMIZER COMPANY, of Matteawan, N. Y., was represented by President Green and by numerous installations of the economizer in plants in Kansas City.

J. M. ATKINSON & CO., Marquette Building, Chicago, has recently put out a new circuit breaker especially adaptable to street railway use. W. E. Pimlott, of that firm, inventor of the breaker, was a convention visitor.

THE BURNHAM & DUGGAN RAILWAY APPLIANCE COMPANY, Boston, Mass., advertised and exhibited its serrated car wheel for use on snow and ice with sweepers, snow plows, etc. This type of car wheel has found many friends among Eastern roads which have tried it for winter use.

THE OKONITE COMPANY, of New York, made no general exhibit, but their goods were in evidence in other exhibits. Superintendent George T. Manson, of New York, represented the company, and was one of the New York special passengers.

THE FALK COMPANY, of Milwaukee, had headquarters at the Midland. Some of the most important engineering work in the street railway field has been done by this company in Kansas City, and particularly the changing of the double cable track on Grand Avenue, between Eighth and Ninth Streets, which was one compound curve, extending the entire block, to simple curves at Eighth and Ninth Street corners, with straight track connecting. The company has also done a large amount of cast-welding track and other work in Kansas City. The company was very ably represented by Gen. Otto H. Falk, vice-president, and Clement C. Smith, second vice-president, of Milwaukee, and by Wendell and MacDuffie, of New York.

THE PECKHAM TRUCK COMPANY had a large exhibit at the hall, and also a parlor at the Midland Hotel, where some very fine models of trucks were shown, and visitors were entertained. Hanna & Grey, Western agents, joined with the company in making the exhibit. At the convention hall the chief exhibit was the Peckham system of double trucks for high-speed elevated and suburban service. One single truck was shown, namely, a Peckham extra long cantilever extension truck, built for the Omaha Street Railway. The double trucks consisted of one "Standard" maximum traction, style 14-D-3; one extra strong maximum traction, style 14-D-5; one pair extra strong maximum traction, style 14-D-8; one short wheel base, style standard, 14-B-3; one short wheel base, style special, 14-B-6; one short wheel base, style "Boston Special"; one short wheel base, style "Kansas City Special"; one extra long wheel base, No. 26. The same general lines are followed in all the Peckham maximum traction trucks, all having swing bolsters and motors suspended outside of the wheel base. The brake mechanism

EXHIBIT OF THE INTERNATIONAL REGISTER CO.

can be operated with either large or small wheels leading. In the case of the extra strong 14-B-5 and 14-D-8, inside brakes are used, which have extra strong angle bar cross section, connected to the side frames, so as to prevent the trucks from getting out of square. The Peckham half elliptic spring traction adjuster can be attached if desired, although the center bearing bolster can be so located as to apply the necessary weight to the small wheels to prevent them leaving the rail. The Peckham Truck Company was one of the first to use the short wheel-base truck now so common, these types having center bearing swing bolsters and motors supported outside of the axle. The short wheel base permits the truck to turn between the car sills, so that the distance of the car body to the ground may be reduced, and only one step is needed. Several modifications of this truck are made by the company, those on exhibition being one Standard construction, style 14-B-3, one Kansas City Special, designed for the use of the Metropolitan of Kansas City, having certain features specified by its master mechanic. Two hundred of these trucks have been ordered, and seventy-five are in service. One Boston Special, designed expressly for the Boston Elevated Railway, was shown; 250 of these being in service. These trucks may be used with either one or two motors, and when used with one motor the brakes are adjusted so as to apply the necessary power without sliding the wheels. The high-speed suburban truck which this company had on display was its No. 26, with the Peckham patent bridge trussed side frames, which are capable of supporting a load of 100 tons per truck. Edgar Peckham, president, and W. M. Wampler represented the company.

THE PACKARD LAMP COMPANY, of Warren, Ohio, was represented by W. D. Packard and W. N. Anthony.

THE WEBER RAILWAY JOINT MANUFACTURING COMPANY, New York, was represented by J. C. Barr, of New York, and E. W. Penfield, engineer, and Fred A. Poor, assistant

engineer, Chicago. The exhibit comprised T and girder rail-joints, compromise joints, and also the insulated joints so extensively used for block signal work. Photographs were also shown from various roads using the Weber joint.

GEORGE W. KNOX, electrical railway engineer of Kohler Brothers, railway contractors, of Chicago, was one of the familiar figures at the convention.

THE ELECTRICAL INSTALLATION COMPANY, of Chicago, had overhead construction on the Metropolitan Street Railway lines as an exhibit, and Superintendent Brett attended the convention.

THE AMERICAN VITRIFIED CONDUIT COMPANY, B. S. Barnard, exhibited samples of conduit duct in various forms, multiple and single, curved and straight.

THE MONARCH FIRE APPLIANCE COMPANY, represented by Gen. C. H. Barney, manager electrical department, made an exhibit, and also a demonstration in front of the hall at noon Oct. 18. A fierce bonfire was built up until it seemed that the boxes of which it was made must surely be consumed. The fire went out the instant a little "Kilfyre" was thrown on it. This is a dry powder compound, and from the tests is of wonderful efficacy in extinguishing fires. This company has a long list of installations, many of them in well known factories.

THE CHARLES SCOTT SPRING COMPANY was represented by D. S. Roche, Philadelphia.

THE STIRLING COMPANY, of Chicago, sent its sales agent, H. R. McCullough.

THE EDWARD P. ALLIS COMPANY, of Milwaukee, needed no exhibit in the hall, but was represented by its work in Kansas City and William E. Dodds.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, had its interests looked after by Frank H. Clark, Western manager, of Chicago.

THE CENTRAL UNION BRASS COMPANY, of St. Louis, had its interests looked after by T. C. White, manager of its electrical department.

THE AULTMAN & TAYLOR MACHINERY COMPANY, of Mansfield, Ohio, makers of Cahall and B. & W. type boilers, had no exhibit, but E. C. Darley, general Western agent at Chicago, sent James W. Gardner, and Alexander H. Lewis, of the Cincinnati branch, was also present.

THE LACLEDE CAR COMPANY, of St. Louis, had its vice-president and general manager, Edward I. Robinson, in attendance.

THE SPEAR & MILLER COMPANY, of Chicago, had a small exhibit of its brake shoes, in charge of J. H. Miller. This brake shoe is used by the Metropolitan of Kansas City. It has a composition center made of iron turnings and asphalt, which, it is claimed, increase the coefficient of friction and double the life of the shoe.

THE VOSE SPRING COMPANY was represented by Gustave Suckow.

THE AMERICAN CAR COMPANY had no exhibit, but President Sutton was in attendance.

THE ST. LOUIS CAR COMPANY sent Assistant Manager Vogel to look after its interests.

H. S. COOPER, consulting engineer, New York and Ithaca, was among the visitors.

CLARENCE BROOKS & COMPANY, 249 Chestnut Street, Newark, N. J., had an exhibit of varnish and paint samples, in charge of A. R. Johnston.

THE B.-R. ELECTRIC COMPANY, a Kansas City supply house, presented an exhibit of the goods for which it is agent, including Ohio Brass Company, Hazard Manufacturing Company, R. D. Nuttall Company, New York & Ohio Company, and the Cutter Company.

THE MILLOY AUTOMATIC TROLLEY CATCHER & ELECTRIC SUPPLY COMPANY, 59 Park Place, New York, showed its automatic trolley catcher, which has an advantage over those in common use in that it not only holds the rope when the trolley leaves the wire, but draws it back 26 ins. so the trolley cannot hit a span wire. It is reset in a second's time. Peter D. Milloy, general manager, explained the device.

THE GOULD STORAGE BATTERY COMPANY, of New York, sent a representative in the person of Rufus N. Chamberlain.

GUY M. GEST, general contractor, Cincinnati, Ohio, has laid over 160 miles of Camp vitrified conduit the past year, and had an exhibit showing a sample of conduit laid in concrete and illustrating the perfect alignment and smoothness of the ducts in charge of T. E. Wood. This exhibit was of especial interest to electric railway men contemplating the laying of underground conduits.

THE CONTINUOUS RAIL-JOINT COMPANY OF AMERICA, Newark, N. J., was well represented by R. F. Braine, general manager; H. M. Montgomery, Chicago agent; W. E. Clark, agent; F. C. Schmitz and J. G. Miller. These gentlemen received visitors in a commodious space in which were found samples of this company's various forms of T and girder rail joints, and decorations in the shape of the familiar and striking continuous-rail-joint poster (showing a black and white section of the joint on a red mat), which accompanies every shipment of these joints all over the world.

ADOLPH HUBER, 917 Franklin Avenue, St. Louis, is the inventor of a sample street railway switch-operating device, which he showed by model. The switch is thrown by the engagement

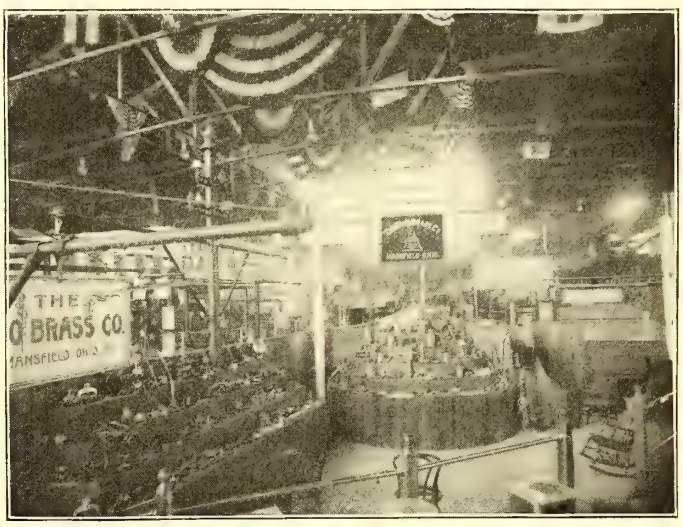


EXHIBIT OF THE OHIO BRASS CO.

of a roller under the car with a cam between the tracks. Mr. Huber has labored to simplify the car mechanism as much as possible to make the cost of equipping all the cars on the line with switch throwers as low as possible.

THE WEBER GAS & GASOLINE ENGINE COMPANY, of Kansas City, exhibited two engines, one for ordinary power purposes and the other with hoisting attachment.

THE UNITED STATES ELECTRIC SIGNAL COMPANY, of Watertown, Mass., has worked on the problem of block signals for single-track roads with turnouts for two years, and presented a system operated by an instrument on the trolley wire. A car, upon entering a block between turnouts, throws signals at both ends of the block (a red signal in front and a white one behind), and the signals cannot be cleared until a car runs out of the block at the other end. Dr. Frederick E. Withee, secretary, and R. J. Ruddick, the inventor, who represented the company, found many interested inquirers.

THE EXHIBIT OF JOHN T. McROY was a most interesting one. He showed the only conduit that is made in 6-ft. lengths. He also showed the many styles of vitrified clay conduit made by his company. Fifty car loads of this conduit are being put in—in Kansas City—by the Electric Light Company and by the Kansas City Electric Traction & Subway Company. Big shipments of this conduit have recently been made to the Kinloch Telephone Company, of St. Louis, and the St. Louis Car Company, and to the Des Moines Edison Light Company. John T. McRoy looked after his own interests, and was ably assisted in doing so by his Western manager, O. C. Pixley, of Chicago.

THE CHARLES SCOTT SPRING COMPANY, of Philadelphia, was ably represented by D. S. Roche, who, owing to the many conventions that he has attended, has many friends, who are glad to meet him again. Mr. Roche gave out as a souvenir a very useful little memorandum book.

COL. JOHN BLAIR MacAFEE, of Philadelphia, the well known contractor and vice-president of the Railways Company General, was looking as handsome as ever, and was, as usual, warmly greeted by his many friends.

THE NEW YORK & OHIO COMPANY, of Warren, Ohio, manufacturer of incandescent lamps and transformers, was represented by W. D. Packard.

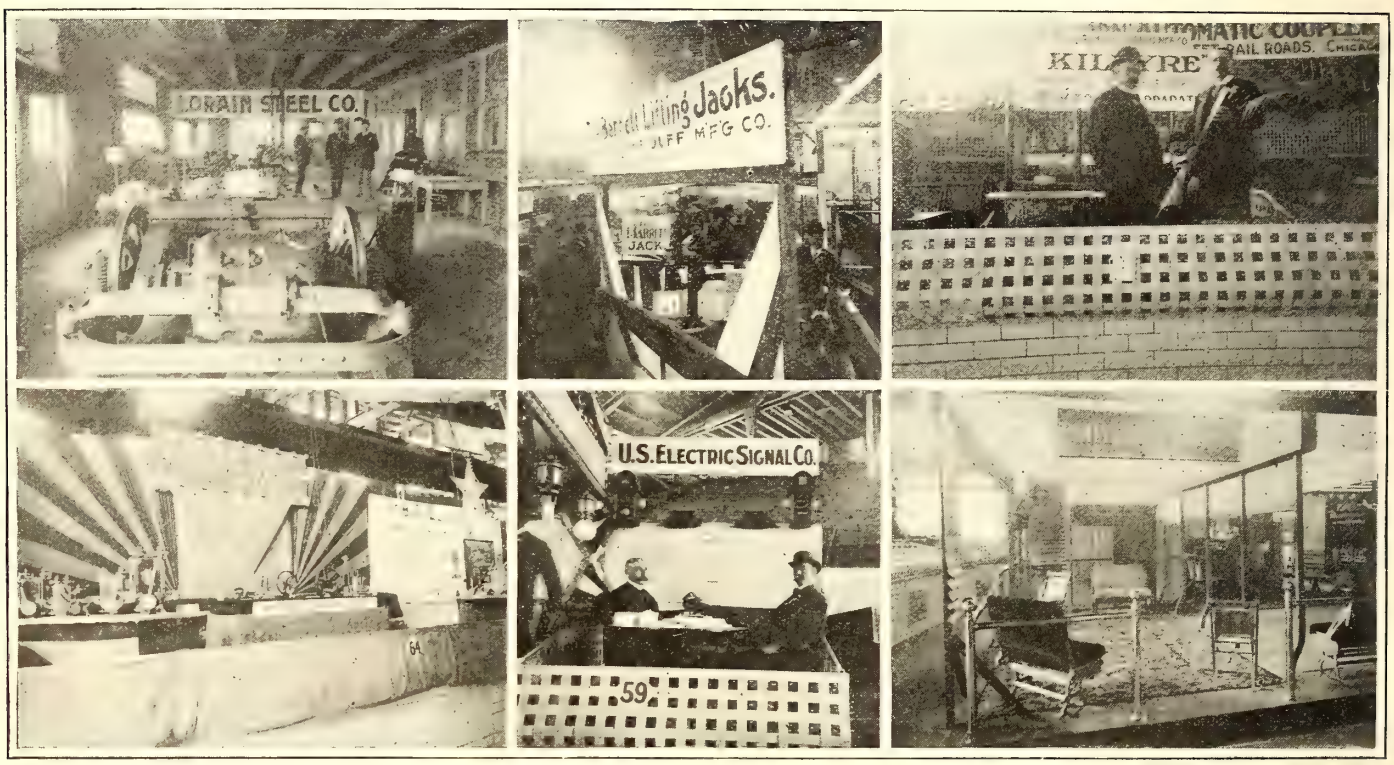
HAROLD P. BROWN, of New York, was present, assisted by Messrs. Holowood, McClure and Immoche. Mr. Brown had all his plans made to have a bond-testing outfit working to show the conductivity of the various bonds, but the special low-voltage dynamo was lost in transit, so he had to be content with showing samples of bonds with plastic alloy contact, and some defective bonds of ordinary type. Mr. Brown came to the convention this year with a voltmeter which is the most delicate portable instrument ever turned out of the Weston factory, the full scale being but 0.15 volt. A very interesting piece of literature has been reprinted by Mr. Brown in pamphlet form, viz.: a report of investigation on the contacts of different metals carried on with high-power microscopes by the Ecole d'Electricité at Paris, under the auspices of the French government. The results showed that in all cases the contact between two hard metal surfaces is of the roughest kind, and that a skin of oxide intervenes between copper and iron contacts. This report is instructive reading, and will be sent to those interested in such matters.

THE PARTRIDGE CARBON WORKS, Sandusky, Ohio, were represented by their manager, James Partridge, and presented an exhibit of carbon brushes. A handsome souvenir paper knife was given to visiting supply and street railway men.

THE H. N. STRAIT MANUFACTURING COMPANY, of Kansas City, exhibited the Monarch standard scales made by it.

THE PHŒNIX METALLIC PACKING COMPANY, 7 South Jefferson Street, Chicago, had a fine exhibit of its lubricator pump. These pumps are driven from the engine, and the length of pump stroke can be accurately regulated to the feed required. A number of pumps with independent feed are included in one device. J. S. Ward, vice-president and general manager, and C. H. Thompson were present.

THE AMERICAN STEEL & WIRE COMPANY is too well known to make much of an exhibit necessary at the convention, but it occupied a small and handsome booth near the hall entrance in which rail bonds and sections of cables, both weather-proof and rubber-covered, were displayed. E. J. Pirtzcker and H. L. Thompson, of the electrical department, Chicago, took care of visitors.



VIEWS OF SIX IMPORTANT EXHIBITS

THE CUTLER-HAMMER MANUFACTURING COMPANY, of Milwaukee, Wis., represented at this convention by C. G Norwood, has recently entered the street railway field. The exhibit pertained entirely to street railway work. It consisted of a switchboard of 500-kw generator panels, a number of the new type circuit breakers in actual operation, an automatic booster controller also in operation, and other switchboard appliances. The circuit breakers known as the W. T. L. differ from all other circuit breakers on the railway market in having a time element. They were described in the October JOURNAL. Special attention at the convention was called to a 500-amp breaker exhibited that was connected across 500-volt bus-bars at Milwaukee Oct. 15. In series with this breaker was a resistance of 0.89 ohm. The breaker was then caused to open the circuit 200 times in rapid succession. This resistance was then decreased to .44 ohm, and the breaker opened twenty-five times in rapid succession. The voltage across the line remained at 590. A system of automatic booster control, something entirely new, was presented for inspection. It consists of a device which automatically throws the booster in and out of circuit as the load demands. The controller was in actual operation, and drew considerable attention. A laminated leaf switch of a most novel character was also shown.

THE CHEATHAM ELECTRIC SWITCHING DEVICE COMPANY, 1212 Frankfort Avenue, Louisville, Ky., has an electric track switch operator thrown from a trolley wire contact. Eight of these have been in use on the Louisville Railway for a number of months, and are said to be giving good service. The plan adopted by the company in some places is to take the switch-boy hire and do the switch-boy work with the device until the switch is paid for, a plan which should be satisfactory to both the company and street railway.

THE PITTSBURGH REDUCTION COMPANY, of Pittsburgh, Pa., the principal aluminum manufacturer of the world, made an interesting exhibit of the uses of aluminum for electrical conductors. There were present at the convention: Arthur V. Davis, general manager; Alvah K. Lawrie, general sales agent, and John A. Rutherford, manager of the Cleveland office of the company. The principal part of the exhibit consisted of reels of aluminum cable, both bare and insulated. The cable on the reels varied in size from 400,000 circ. mils to 1,000,000 circ. mils, although the company showed short samples of sizes, both larger and smaller than the above mentioned. There was a very complete exhibit of the different styles and methods of joining aluminum cables, showing that this question, which has supposedly presented some difficulties, has been completely solved. The different styles of joints included the ordinary type of soldered sleeve joints, soldered spliced joints, and mechanical and spliced joints which require no solder. There was also shown the new compression joint, the patent rights for which the company has just acquired, by

which process a sleeve is cold-welded, by extreme pressure, onto the cable, so that the wires of the cable and the sleeve form practically one solid mass of metal. As the principal object of the exhibit was to show the different sizes and styles of aluminum street railway feeders, there were exhibited also reels of telephone and telegraph wire and reels of wire and cable of the sizes commonly used for high-tension power transmission. There were also exhibited reels and samples of insulated wire for electric lighting purposes. This was General Manager Davis's first street railway convention, which, together with recent developments in the use of aluminum for electrical conductors, would seem to point to the fact that it will find an important place in electric railway work in the near future.

THE AMERICAN STREET RAILWAY PAVING & IMPROVEMENT COMPANY, Springfield , Mass., was represented by C. F. Smith, manager, and exhibited its system of cast-iron paving blocks, whereby a girder rail may be practically transformed into a grooved rail. These hollow cast-iron blocks slip over the tram of the rail, and weigh, in the heaviest types, 27 lbs. per yard of rail. Two years ago 9000 ft. of this rail was laid in Springfield, and is reported to have been an excellent investment.

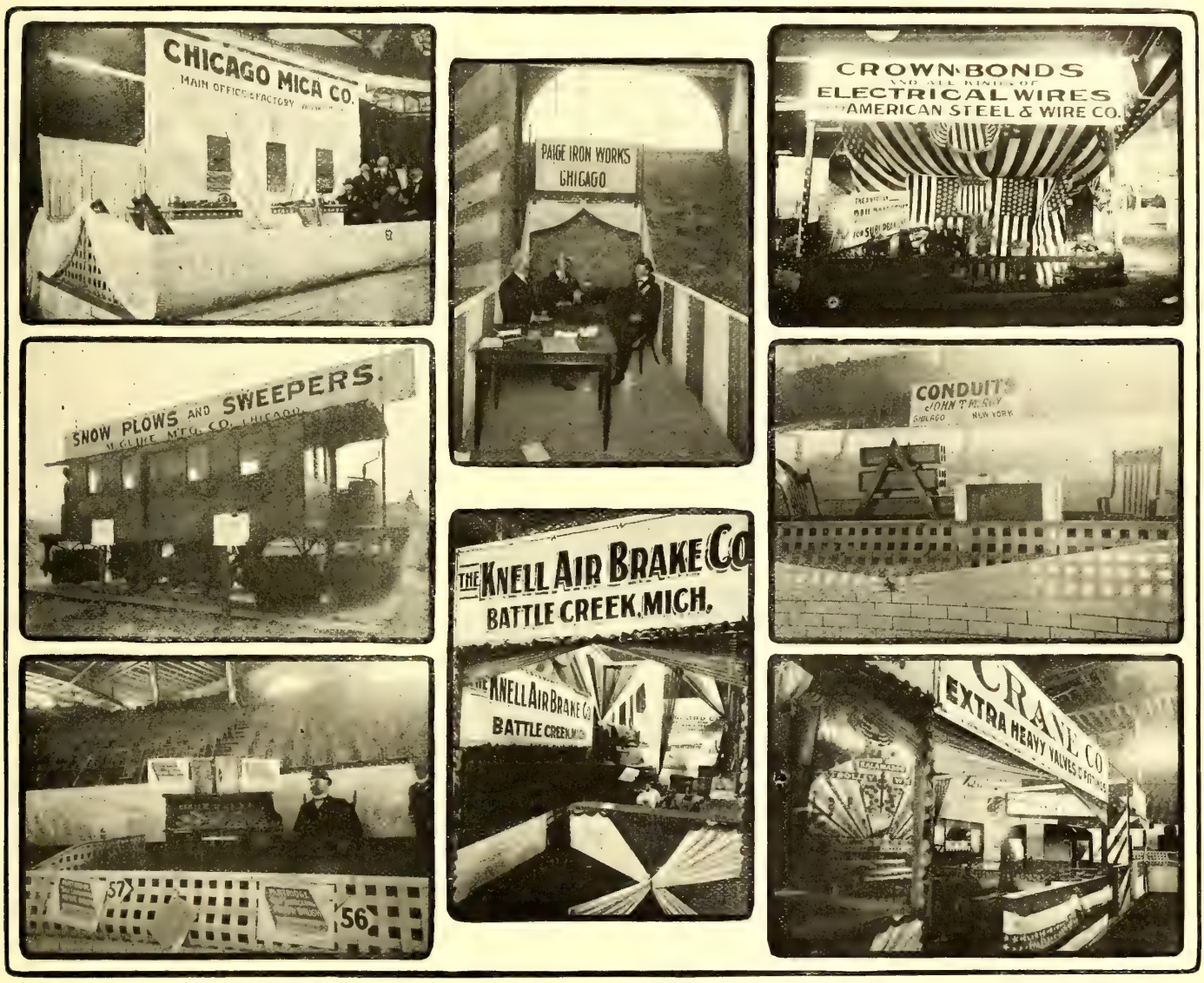
POMEROY & FISCHER, New York, importers of varnishes and colors, had a handsome little display. Joseph Pomeroy was present at the convention.

THE PAIGE IRON WORKS, of Chicago, were represented in the person of E. S. Nethercut, its engineer, who distributed literature relating to the company's work from a booth under the west gallery. A handsome pamphlet illustrating the special work put in for the various elevated roads of Chicago was the most interesting publication offered, and one in which the company justly takes pride.

THE W. R. GARTON COMPANY, of Chicago, had a small space in which Multiplex reflectors and General Equipment circuit breakers were shown. Mr. Garton himself was present, adding to his already long list of acquaintances, and W. H. Card also represented this company. Mr. Garton distributed a neat aluminum paper knife and rule for a souvenir.

THE CURTAIN SUPPLY COMPANY, Chicago, made its usual exhibit of car fixtures and curtains. W. H. Forsyth and A. L. Whipple were in charge.

THE PANTASOTE COMPANY, 29 Broadway, New York, had a very handsome exhibit, and showed several new designs in silks and woven fabrics. Pantasote has been long known to the trade, and needs no explanation to convention goers, and is looked upon and recognized by the railway world at large as one of the best and most practical curtain materials on the market. The exhibit was in charge of J. M. High and H. M. Grier.



VIEWS IN AND AROUND THE CONVENTION HALL

THE AMERICAN CAR & FOUNDRY COMPANY, of St. Louis, had headquarters at both the convention hall and hotel. It exhibited under the direction of Scott H. Blewett, general sales agent, a number of car wheels and sections of car wheels; also parts of broken wheels showing their interior construction. From this company there were also in attendance T. F. Bixby, district manager St. Louis plant; James Connolly, general superintendent of foundry, St. Louis plant, and J. L. Dillon, sales agent. The manner for showing the character of the chill in the tread of the wheel and the strong fibrous iron in the plate and spoke commends itself to those who use street car wheels. A piece of metal is broken from the wheel and the general character of the wheel is preserved, although this piece has been taken from it. These wheels are mounted on a mandrel, and the entire circumference of the wheel can be brought under the eye of anyone examining

it. The company's plants are located at Buffalo, N. Y.; Berwick, Pa.; Chicago, Ill.; Detroit, Mich.; Huntington, W. Va.; Indianapolis, Ind.; Jeffersonville, Ind.; Milton, Pa.; St. Charles, Mo.; St. Louis, Mo., and Terre Haute, Ind.

WINNE & KELLOGG, Chicago, general Western agents for Adams Cook's Sons "Albany Grease," and also dealers in high-grade lubricating oils, engineers' and mill supplies, had one of the boxes at the Convention Hall, where Ben B. Kellogg met the street railway men and distributed a handsome souvenir in the shape of a thermometer.

THE AMERICAN BRAKE SHOE COMPANY, of Chicago, was represented by F. W. Sargent, of the Sargent Company, Chicago, and Arthur Gemunder, of the Ramapo Iron Works, Hillburn, N. Y. The two latter named companies and Parker & Topping, St. Paul, Minn., are the selling agents for the American Brake Shoe Company. This company's "Diamond S" brake shoe, as is well known, is made of bundles of expanded metal, around which cast iron is poured. The combined output of the company's plants exceeds 100 tons of brake shoes per day, which is of itself a sufficient proof of the merit of the article.

THE DEARBORN DRUG & CHEMICAL WORKS, of Chicago, were represented by R. F. Carr and C. A. Stanfield, who

EXHIBIT OF THE WESTINGHOUSE CO.

exhibited extreme samples of scale formation from steam boilers and samples of water tube valves and connections, showing the different stages of galvanic action pitting and corrosion produced from different boiler feed-waters. There are very few cases of feed-waters that do not require some treatment, and the Dearborn Drug & Chemical Works, in their well equipped laboratories in Chicago, make a thorough mineral analysis of feed-waters, and scientifically treat same according to their different conditions. They have taken this subject out of the hands of the incompetent fakirs, and are to-day furnishing many of the large street railway and lighting interests of this country. They have branch offices at St. Louis, Denver, St. Paul and San Francisco. Their laboratories are always open to the public for any general analytic testing work. The company also has an extensive business in lubricating oils and greases, furnishing oils which most economically lubricate under special conditions of steam pressure. When carefully used, the highest grade oils prove by far the cheapest. The representatives gave as souvenirs to the ladies a bottle of perfume, a product of the company's laboratories, and to the gentlement a mechanical puzzle. The company's booth was handsomely decorated in green, light blue and red.

THE AUTO APPLIANCE COMPANY, of Chicago, showed a new automatic car coupler which interested street railway men. Thomas I. Duffy was in charge.

THE W. T. VAN DORN COMPANY, of Chicago, was represented, as it has been for many years past, by W. T. Van Dorn. Mr. Van Dorn's couplers are now standard on every elevated road in the world, and no other automatic coupler than the Van Dorn is in use on the street railway cars of this country. Mr. Van Dorn has recently patented a device for preventing derailment of fast trains, and another for cleaning the hot-air pipes of furnaces for heating dwellings. Recent tests of the latter prove it to be a remarkably successful invention.

THE ST. LOUIS REGISTER COMPANY, of St. Louis, was represented by Giles Allison, of New York, and William Kirchoff, the inventor. J. W. Allison, of St. Louis, was also present for a short time. This register was fully described in the JOURNAL for October last. It attracted universal attention, and the company was more than pleased with the favorable comments by street railway officials. This new register is the result of years of study and experience. The name is already well known, and the self-recording feature must undoubtedly create a demand for it.

PIERCE, RICHARDSON & NEILER, of Chicago, were present in the person of R. H. Pierce and R. E. Richardson. The members of this firm are consulting engineers of the Metropolitan Street Railway Company and the Kansas City Electric Light Company, a consolidation of all the light companies of the city, and of which latter company Mr. Richardson is general manager.

THE MEYERCORD COMPANY, of Chicago, showed delegates and visitors its decalcomania transfers for lettering, striping and decorating cars. The company has recently built and equipped a new factory in Chicago to care for its enormous business. Among its customers are many of the street railway companies and car builders. The company showed a photograph of a large interurban double-truck car, which had been striped, lettered, decorated and varnished with one coat of varnish, the whole being completed in nine hours. Henry C. Clasen was in charge of the exhibit.

THE CRANE COMPANY, of Chicago, made its usual exhibit of high-pressure valves and other steam appliances.

THE NORTH AMERICAN RAILWAY CONSTRUCTION COMPANY, of Chicago, was able to direct visitors to much street railway construction by this company in Kansas City, where it has at this time a new contract upon which it is working. The president of this company, A. S. Littlefield, was one of the best known men at the convention. D. J. Evans, of this firm, was also in attendance.

THE MODOC SOAP COMPANY, of Cincinnati, was represented by C. C. Grace. This company's liquid car cleaner is used by nearly all of the steam railroads in America and by many street railways. It cleans the car without injuring the varnish, is a varnish food, and it is claimed that it will much prolong the life of the finish of the car body. The company made no exhibit, but its genial representative made many friends for his product, as well as for himself

THE GREEN ENGINEERING COMPANY, of Chicago, made no exhibit at the Convention Hall, but its traveling grate could be found at several of the Metropolitan power houses. W. M. Green, president, and George H. Klumph, Western manager, were present. The company has sold an immense number of grates this season, having made some of the largest installations ever made in this country.

THE STANDARD RAILWAY SUPPLY COMPANY, of Chicago, was present in the person of its president, Garson Myers, for many years well known to convention goers. Mr. Myers also represented the Crucible Steel Company of America, Pittsburgh, Pa., manufacturers of railroad springs, forgings and track tools.

THE CHARTER OAK STOVE COMPANY, of St. Louis, showed one of its street car heaters.

THE VAN DORN & DUTTON COMPANY, of Cleveland, was represented by W. A. Dutton. This company's shops are and have been for many months past so filled with work as to necessitate running both day and night to keep up with orders.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY had a very prominent position near the center of the hall, and its space was one of the most prominent and attractive in the building. The largest machine exhibited by the company was a 650-kw generator, being one of four built for the St. Louis Transit Company. The armature was shown separately. At one side of the space was a five-panel switchboard, being a duplicate of that shown by the British Westinghouse Company at the recent

British Tramway and Light Railway Exposition at Islington. On the other side of its space the company also showed two No. 68 motors mounted on the McGuire truck, and other apparatus. A new railway motor catalogue was issued, and a pamphlet on the new motor rating adopted by the company, based on the current carried continuously for ten hours with a temperature rise not exceeding 75 degs. C. The handsome booth was draped in yellow and black bunting and carried a large sign in red lamps bearing the name, "Westinghouse." The miscellaneous apparatus shown included Wurts lightning arresters, switches, circuit breakers, fuse blocks, voltmeters, ammeters, etc. Representing the company were F. H. Taylor, N. W. Storer, G. Berentsen, W. H. Wells, W. M. Probasco, P. N. Jones, R. S. Brown, C. S. Powell, C. A. Bragg, J. R. Gordon, C. B. Humphrey, G. Pantaleoni, H. C. Ebert, F. C. Newell, C. F. Medbury and E. Dyer.

THE ELECTRICAL INSTALLATION COMPANY, of Chicago, had a most practical exhibit in the fact that the company had done a large amount of construction work in Kansas City. The company attached signs to some of this work, stating that it had been erected by the Electrical Installation Company. Fred H. Fitch, vice-president, and James A. Brett, general manager of the company, were present in its interests.

THE CHICAGO MICA COMPANY was represented by Charles W. Cobb.

C. C. GRACE attended the convention in the interests of the Modoc Soap Company.

HEYWOOD BROTHERS & WAKEFIELD COMPANY, of Boston, had no exhibit, but was represented by J. D. Guillow.

L. E. MYERS, contractor and engineer, of Chicago, was present representing the Peoria & Pekin Terminal Railway. Mr. Myers has done a large amount of construction work in Kansas City.

EDWARD B. KITTLE AND HENRY G. ISSERTEL, JR., attended the convention in the interests of the Sprague Electric Company.

THE KRAUSHAR LAMP & REFLECTOR COMPANY, of St. Louis, was represented by C. Kraushar.

C. S. LEHMAN and George E. Watts, of the Columbia Incandescent Lamp Company, were in Kansas City in the interests of the Columbia lamp.

THE STAR BRASS WORKS, of Kalamazoo, Mich., had for their representatives at Kansas City C. A. Peck and Lloyd Roberts.

THE NEW JOHN STEPHENSON COMPANY was well represented at the convention by its general manager, P. M. Kling. Mr. Kling has attended many conventions and has many friends among the delegates, who congratulated him upon the re-entrance of the Stephenson Company in street car construction, and seemed well pleased that he had been selected as general manager of the company.

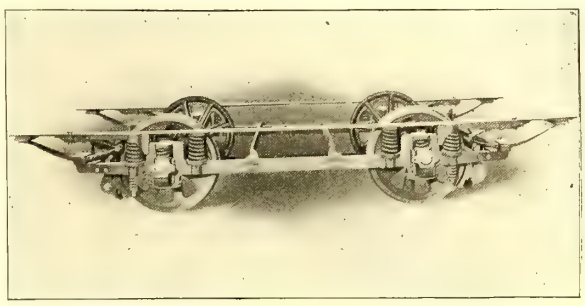
A TRIP to Fort Leavenworth by trolley, which was taken by a number of the delegates, afforded the Magann Air Brake Company an opportunity of showing the operation of its air brake system. Mr. Rutherford, of the Detroit office, who was in attendance at the convention, accompanied the party, and was the recipient of many congratulations upon the excellent showing made by the brakes.

THE JACKSON & SHARP COMPANY, of Wilmington, was represented by J. Monteith Jackson.

THE GENERAL ELECTRIC COMPANY occupied a large space nearly in the middle of the convention hall, tastefully decorated. In the rear the name of the company appeared on a sign, studded with incandescent lamps. The exhibit consisted of a rotary converter, a transformer set, railway motors and controllers and supply material. The rotary converter, which was placed in the center of the exhibit, was a 600-kw, three-phase, 550-volt machine for railway purposes. There were three 250-kw air blast transformers to be used with this rotary converter, which occupied three of the corners of the space. A Peckham truck mounted with two GE-67 motors stood in the fourth corner. Occupying other parts of the space were a GE-54, a GE-67, a GE-57 and a GE-73 railway motor, these representing respectively 25 hp, 38 hp, 50 hp and 75 hp. Three controllers were shown: K-6, K-10 and B-19. K-6 is designed for four motors from 30 hp up to and including 40 hp each, or two motors from 60 hp up to and including 80 hp each. K-10 is designed for two motors up to and including 35 hp each. B-19 is an electric brake controller designed for four motors up to and including 35 hp each, with brake connection for four motors. A variety of railway line material and supplies was also shown. The exhibit space was 1500 square feet, and the exhibit was erected and was in charge of R. A. Swain, of the Chicago office of the General Electric Company. Other representatives present were J. R. Lovejoy, general manager of the light, railway and power department; J. G. Barry, assistant manager New York department; J. H. Armstrong and C. G. Priest, of Schenectady; J. C. Kalish, of Buffalo; R. H. Beach, of New York; C. C. Pierce, of Boston; T. H. Bailey, of Chicago, and E. H. Mullen, of New York.

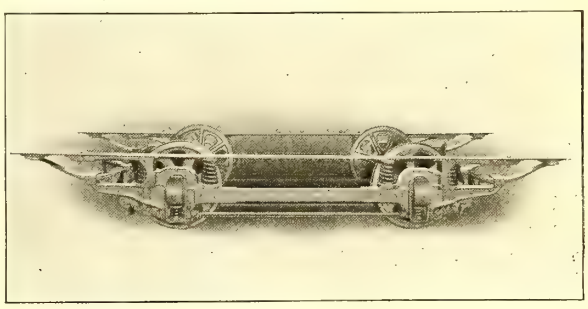
The Exhibit of the McGuire Manufacturing Company

The McGuire Manufacturing Company, of Chicago, made one of the best exhibits to be seen at the Kansas City convention, and was very liberal with its souvenirs in the shape of a memorandum book with aluminum covers, a card of the company on one side and an engraving of its No. 39 truck on the other. The first



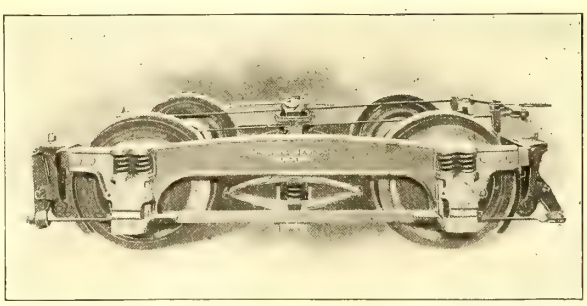
SOLID STEEL COLUMBIAN TRUCK

thing that caught the attention of the visitor was their sweeper, which occupied a position directly in front of the main entrance to the hall. This sweeper was one of fifteen sold to the Metropolitan Street Railway, of Kansas City, and was very generally examined and most favorably commented upon by all who saw it. It was the



A 1 SUSPENSION TRUCK—PITTSBURGH TYPE

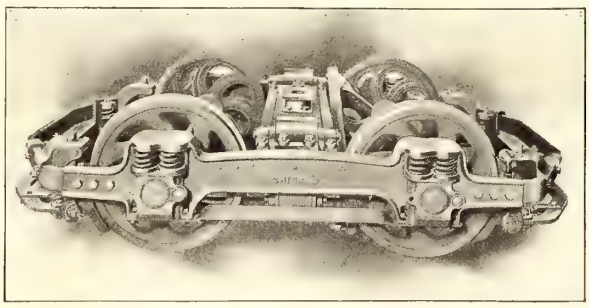
only exhibit of this kind on the ground. The long distance and the great cost of handling a machine of this kind, that weighs 24,000 lbs., makes it an expensive exhibit. There are over 500 of these machines in service throughout the country, and it is acknowledged to be a fully up-to-date sweeper. In the Westinghouse exhibit was



NO. 35 DOUBLE TRUCK

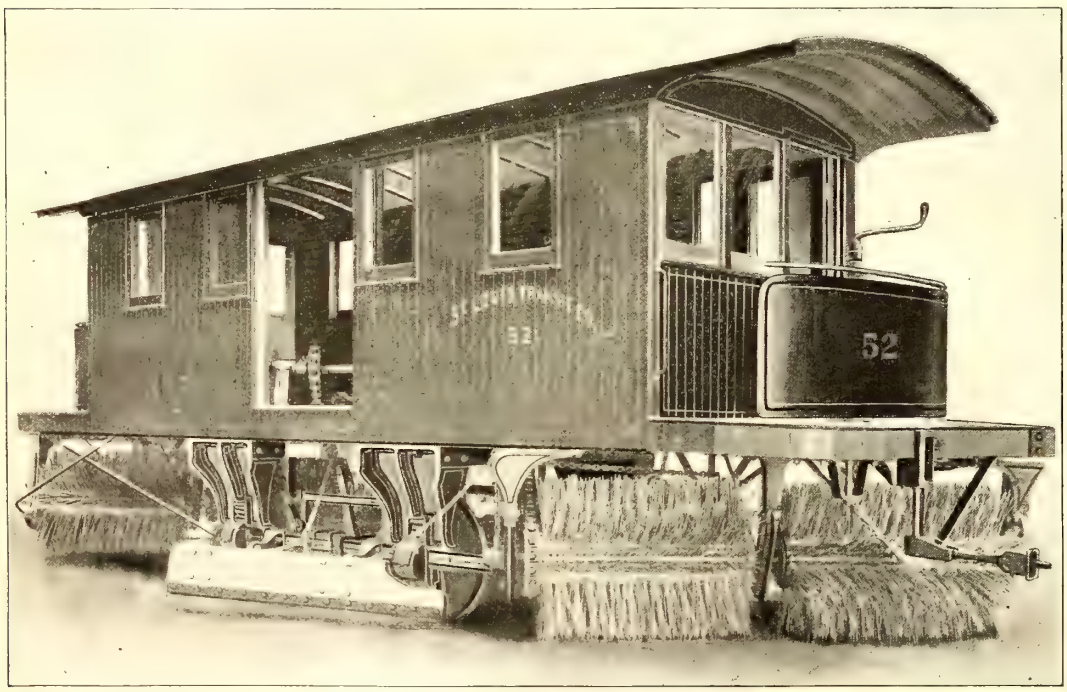
shown the McGuire A1 suspension truck (Pittsburgh type), equipped with the Pittsburgh standard motor. This exhibit was very carefully examined by a great many people on account of the record of this entire equipment. There are over 800 of this type in

use in Pittsburgh alone. It is the standard also in Havana, Cuba, and in many other places. It may be mentioned here that the service in Pittsburgh is one of the most severe in the country, because of its many high grades. Some of the hills over which these lines run being as high as 12 per cent grade, they call for the most efficient brake arrangement and general stability of construction. The main exhibit of the company was under the galleries. The first truck was its No. 39, and was one of the hundred now being built



NO. 39 MOTOR TRUCK

for the Chicago Union Traction Company, of Chicago, where it is the standard, as it is in many other important places throughout the country, particularly the Indiana Railway, of South Bend, where they are required to make a schedule time of forty miles per hour, sometimes reaching fifty miles per hour. This truck has cast-steel sides and bolsters, and is built as nearly on Master Car Builders' lines as it is possible for an electric truck, the motors being hung outside of the axles. Its short wheel base—4 ft.—permits it to swing inside of the sills, bringing the car body within 26 ins. of the rail, necessitating but one step. The next truck in the



COMBINED SNOW PLOW AND SWEEPER

exhibit was their maximum traction truck. This truck is also made of cast steel with swing bolster and of the adjustable traction type. It is so constructed that as much as 75 per cent of the load may be put on the driving wheels if desired, with a cam and roller attachment which shifts a part of the load to the rear wheels on curves, completely overcoming the objection to most of the maximum traction trucks. There was also exhibited one of the solid steel Columbian trucks, which is the standard on so many of the railways throughout the country. The McGuire Manufacturing Company was the first to build solid steel frame trucks, and has been imitated by all the truck manufacturers who have acquired any standing. This truck is so designed and constructed that its carrying capacity can be adjusted to any required load. The frame consists of solid steel sides of any required wheel base, and has eight spiral and four three-quarter elliptic springs. The pedestal, spring cups and spring caps are all cast in one piece, forming the end of each side frame, and is welded to rolled steel pieces 2 ins. x 4 ins., by which the length of the wheel base is regulated. The minimizing of parts is carried to its fullest extreme in the construction of this truck frame. All these different trucks are equipped with standard brakes, which include the McGuire Company's elastic brake hanger, a very popular feature of their trucks. This device absolutely prevents kicking, chattering or rattling of brakes, and automatically takes up its own wear and lost motion. The Royal Flush fender came in for a very generous inspection, as nearly every railway man is very much interested in this subject. This fender seems to do everything that the more expensive types will do, and has the advantage of being a simple and low-priced fender, which is a taking feature. Mr. McGuire christened the fender "Royal Flush" because he says he thinks it is hard to beat. It also exhibited its latest types of Columbia car heaters, one of which sits over the seat and the other sits in the seat. This is a very handsome piece of car furniture and is being very generally used throughout the country. In Chicago alone over 900 of them are in service. In connection with its fender exhibit, a section of platform showing their spring guard, which is now being used by many roads, was shown. The North and West Side roads of Chicago have them on all their equipment. Several of the lines in Dayton and other places are using them, and report most favorably upon their operation. There was also an exhibit of brake handles. Take it all in all, this was one of the most creditable exhibits at the convention. The company was represented by W. J. Cooke, vice-president of the company, and T. J. Callinan. Mr. Cooke reported that they made a great many sales of sweepers, trucks, fenders and stoves, an unusual occurrence at a convention.

A Useful Automatic Lubricator

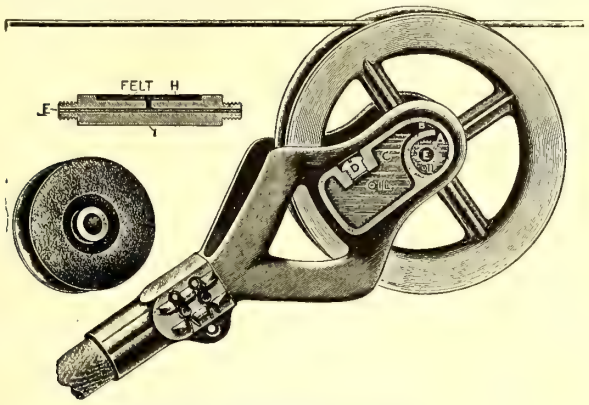
A device which will be found of great convenience for oiling reciprocating parts of engines, pumps, air compressors, etc., is being manufactured by J. L. Robertson & Sons, New York. It consists of a large cup, filled with grease instead of oil, the base of which is screwed firmly into the cross-head, connecting rod, eccentric strap or other part to be lubricated. The grease is fed to the bearing by means of a piston, which, while the engine is in motion, slowly forces it out of the cup. This piston is operated by a small pendulum at the side of the apparatus, which by means of a pawl and rachet, worm gear and screw moves it forward at an adjustable speed. As the part to which the lubricator is attached moves backward and forward the pendulum continues to oscillate, but when the machinery comes to rest the feed automatically stops. By means of an auxiliary thumb-nut at the top a much faster expulsion of the grease can be attained. The lubricator is simple in construction, easily applied to the engine, and readily filled when empty. It can be applied to any kind of machinery having reciprocating parts, and in any position, and is made in various sizes to meet all requirements. The inventor is G. U. Merrill, Paterson, N. J., but the manufacturing company is placing the automatic lubricator on the market.

An Improved Self-Oiling Trolley Harp

During the three years that the trolley harp shown in the accompanying engraving has been on the market the manufacturers have made many improvements in its construction. It is now one of the most efficient and durable of the self-oiling harps, and is so simple that its operation is practically perfect. It is made in both brass and aluminum, the latter metal giving most satisfactory results and allowing the use of weaker springs than the heavier metal.

As shown by the illustration, there are two chambers to receive

the oil, the one around the axle being much the smaller. The larger reservoir contains the supply of oil, which is fed to the auxiliary reservoir every time the trolley is lowered. From there it flows through the central passage that is bored in the axle or spindle on which the wheel revolves. A piece of felt in a slot on the axle prevents too free a flow and gives a good distribution of the oil.



SELF-OILING TROLLEY HARP

There is sufficient oil placed in the harp at each filling to last from ten to thirty days.

The long bearing of the trolley wheel gives a true and even running, and thus reduces the wear. All the oil is used in lubrication, and the ordinary trolley oiler at the end of the road is dispensed with. The wheel running smoothly and with perfect lubrication, there is much less noise than with ordinary wheels, and the device is less liable to leave the trolley wire. For this reason it has been in use on some of the large heavy traffic, high-speed roads of the country with great success.

The self-oiling trolley harp above described is known as the "Excelsior," and is manufactured by the International Specialty Company.

Two Large Engines at the Paris Expositson

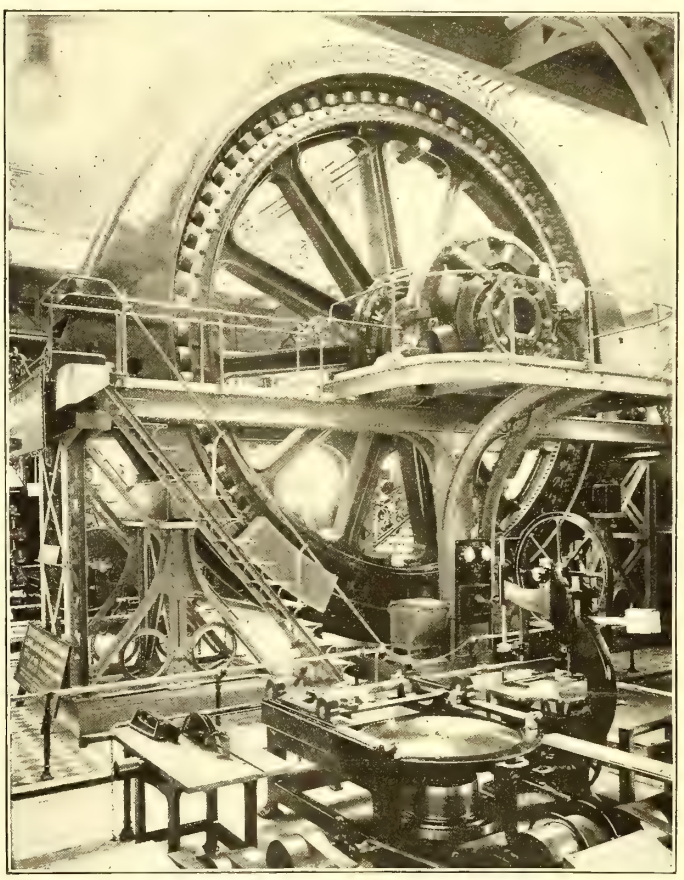
Prominent in the British section of the foreign power house at the Paris Exposition is the combined exhibit of Willans & Robinson, of Rugby, England, and Siemens Brothers & Co., of London. The engine is of the well known central valve type, and the dynamo, on the extension of the shaft, furnishes continuous current at 550 volts. The essential feature of the Willans engine, and one which contributes most to its remarkably steady operation, is the application of the constant thrust principle at all the joints, thus assuring noiseless running and freedom from the shock that is always present in an engine in which the strains are continually being reversed, an effect particularly noticeable in high-speed machinery. The first use of the Willans engine was for steam launches, where it proved eminently successful, as it was possible to secure a much higher speed with this type of engine than was previously attained, thereby reducing the weight and space occupied. The same consideration of economy of space with high rotative speed made this engine suitable for direct connection to dynamos for supply of electric current for power and lighting.

The engine on exhibition at Paris has a nominal output of 24 hp, at 200 r.p.m., but for short periods of time it is capable of developing 3000 hp. This is actually the largest engine built by the company, yet it is designed on practically the same lines as the smaller engines, having three cranks at 120 deg., and for each three superimposed cylinders for high pressure, intermediate and low pressure steam, and of 18⅞ ins., 30 5-16 ins. and 48 ins. diameter, respectively, with a stroke of 23⅝ ins. In order to keep all the strains in one direction, steam is admitted on only one side of the pistons, making a single-acting engine. For the exhaust, the inertia of the moving parts keeps them in compression for the beginning of the up-stroke, and an air cushion in the lower cylindrical guide prevents any change in this condition, as acceleration is reduced in the latter part of the stroke. A high speed necessitates a very accurate balance of the several lines of pistons acting on the three cranks, and this is obtained by having all exactly similar, and complete expansion is made successively through the three cylinders constituting each set. The air cushion is obtained by having a crosshead in the form of a piston working in a cylinder closed at the upper end, and the power stored away during compression of the air is given out on the return stroke. Lubrication of the cranks and other working parts, except the cylinders and valves, is effected by filling the crankshaft chamber with oil and water, and allowing the cranks to dip in the mixture and splash it on to the guides and pins.

The Siemens dynamo driven by the above engine is of the 16-pole type, giving a normal output of 1500 kw at 550 volts, at 200 r.p.m., but capable of bearing a temporary overload of 20 per cent for a short time. The field frame, of cast steel, is 14 ft. in diameter and 33½ ins. wide, and carries internal radial poles with soft iron pole pieces screwed on. The commutator, being over 5 ft. in diameter, is designed to allow of repair to individual segments without the necessity of loosening the whole number.

In many industrial applications of late years it has been found that high-speed engines give the best results, when one of the prime requisites is close uniformity in speed. For cotton mills this is particularly true; but it is also found that high-speed engines are very well suited to electric traction and transmission of power, for the variation of load is in such cases often very severe, and a high-speed engine governing quickly is especially desirable for such work. The Willans engines have been very successful in filling these requirements, and the performance of the Exposition engine is entirely satisfactory.

The Allgemeine Elektricitäts-Gesellschaft occupies the center of the German annex to the Electricity Building with an immense fly-wheel alternator having an outside diameter of over 28 ft. It was not practicable to put in a 4000 hp engine to drive this alternator, whose normal load is 3000 kw, and it was decided to erect it in the annex instead of in the main power house. The machine is supported, clear of the floor, by heavy steel framework, allowing of an



LARGE ALTERNATOR—PARIS

inspection of the whole, as shown in the engraving. A special shaft has been fitted, and a direct-current motor is provided to revolve the fly-wheel, which is 24 ft. 3 ins. in diameter and has 72 poles. Three-phase current at 6000 volts is given by this alternator, running at 83 r.p.m. It is destined to furnish current to Berlin and the environs, partly alternating and partly rectified, for the supply, in conjunction with other machines already running, of electric light as well as for traction and transmission of power. The weight of this alternator, complete, is 160 tons, which necessitated the use of eleven eight-wheeled cars for transportation, the armature frame and field casting being each in four parts. The annex was not intended for heavy machinery and was too light to support a traveling crane, so the parts had to be assembled by means of portable cranes and special devices. Notwithstanding these difficulties, the machine was erected in three weeks.

The New Jersey & Hudson River Railway & Ferry Company has just issued a very tasteful time table, giving a map showing the route of the company and a view of New York City from a point on the line.

Experimental Conduit Line of the London City Council

In the tramyard of the London County Council at Camberwell is installed an experimental length of an electric tramway track. The line has been erected so as to be tried under actual working conditions; it is in the open air, has a curve of 90 ft. radius and a gradient of 1 in 40. The total length of the line is 256 ft. This, the first portion of the electric tramway work of the London County Council, is now in running order, and surrounded as it is by numerous stables, sheds and buildings containing all the paraphernalia of an extensive system of horse tramways, appeals in a peculiar manner to the onlooker. In the center of a vast home of the oldest tramway fashions has sprung up a small, one might almost say, a toy, length of the newest tramway practice. The entire plant formed part of the exhibit of the British Westinghouse Company at the International Tramways and Light Railways Exhibition held in London last June. This operating tramway was the most striking of all the exhibits, and was described and commented upon in practically all the technical journals and newspapers at that time. It may, however, be as well to glance over the main points of this tramway system, now that it is likely to be a center of interest both to the ratepayers of London and the authorities of other cities who are waiting for London's example before deciding upon electric tramway schemes themselves.

EXPERIMENTAL CAR AND TRACK FOR TESTING UNDERGROUND CIRCUIT—LONDON

The tramway was purchased by the London County Council for the purpose of training motormen to drive electric cars and to enable their engineers to carry out certain experiments, while at the same time able to see for themselves the appearance and behavior of the conduit system under actual working conditions. The generating plant, consisting of gas engine and dynamo, has been hired by the Council until their own station shall be available. The line is built on a series of cast-iron yokes, placed 5 ft. from center to center, and each set on a bed of concrete 4 ins. thick. This thickness is sufficient for the heaviest traffic on the street. The yokes bear the tram rails at their extremities and the conduit section and channel rails in the center. The conduit between the yokes is of concrete about 4 ins. wall. The lead and return conductors are run side by side in the conduit. Both are insulated at their supports by stoneware insulators. The conductors are split up into sections, each section being coupled by a main branch to a continuously insulated main running the full length of the track. An automatic switch is placed in each of the branch mains, and is so arranged that its corresponding conduit conductor section is only coupled to the main when a car is actually over it. The car is equipped with two Westinghouse No. 49 motors, each 35 hp, and coupled to the car axles through a single reduction gear. Current is collected from the conduit conductors by means of a contact plow fixed beneath the car, and passing through the narrow surface slot, ¾ in. wide, of the conduit.

The contact plow is suspended by a hinge from a small carriage beneath the car. The hinge is for the purpose of allowing the plow to accommodate itself to curves in the track. In addition, the carriage allows a lateral motion almost equal to the full width of the car, so that a considerable eccentricity of the conduit channel between the tracks can be allowed. The advantage of this will be seen in certain parts of the track construction, such as turnouts, etc., and in addition it will, of course, be useful in avoiding obstacles in the roadway. The car is equipped with a Westinghouse magnetic blow-out type controller at each end for facilitating running in either direction, and with an electrical brake in addition to the ordinary hand brake.

The power for operating the line is yielded by a 75-kw, 500-volt generator direct-coupled to a 124-hp Westinghouse three-cylinder gas engine. The engine is of the type which has attracted so much attention and become so popular during the last two years or so, due to its economical working and sensitive governing.

London Letter

[*From Our Regular Correspondent.*]

Work on the Glasgow tramways is now being pushed as fast as possible, and the laying of new tracks or putting up of overhead construction work is being proceeded with in almost every part of the city. The power house is also making rapid progress, and recently it was inspected by the tramway committee. Mr. Parshall, the consulting engineer, showed them over the buildings and explained the machinery and its arrangements. There were two special cars of different designs submitted for the consideration of the committee, with the result that the present double-decker now on the Mitchell Street-Springburn route was formally selected as the most suitable for the new system over the whole city. At the car houses at Coplawhill they are at present turning out at the rate of five new cars every week. Mr. Young believes that the electric system, embracing the entire city, will be inaugurated about the beginning of April next year, just on the eve of the exhibition.

The overhead work in Glasgow, which is being done by Macartney & McElroy, is particularly interesting, wherever possible the span wires being attached to the buildings, doing away with the necessity of many poles. The corporation has been no respecter of buildings, and some of the finest buildings on the streets have got the little bracket attached to their walls from which the span wire is strung. In view of the large traffic which is expected in Glasgow during the exhibition, the corporation is making preparations to widen certain of the streets, which have been too narrow for many years, notably the west end of Sanchichall Street. Trouble is being experienced with many of the property holders, but the corporation, by invoking the aid of the courts, will succeed in its estimable work in good time.

The Brush Electrical Engineering Company, Ltd., has taken up the manufacture of traction trucks at its Falcon Works, Loughborough, and is thus the first and only firm that builds this class of manufacture in Great Britain. The company is at present making three standards, which cover the general needs of electric traction,

as follows: Four-wheel single type, four-wheel bogie type, and the maximum traction type. A special shop has been erected and equipped under the control and management of E. E. Cook, an engineer who has had long and successful experience in this branch of manufacture in the United States. The Brush Company is therefore in a position to quote to any specification and to handle orders of any probable magnitude.

An extensive system of new tramways, partly electrical, is projected, to join up Greater London, if Parliamentary sanction is forthcoming next session. The London United Tramways (Ltd.) propose to extend their existing lines to St. Pancras, Marylebone and Fulham, and cross the Thames to Putney, and also northward to Willesden and Southall and westward to Sunbury. The Surrey extensions will include a length of over four miles, connecting Putney with Richmond, which will proceed into Middlesex over a new bridge across the Thames. Another line will be from Hammersmith Bridge, and there will also be an extension from Kew Bridge to Richmond. In Middlesex the scheme will comprise, among others, rails connecting Hounslow with Cranford, Brentford with Ealing, Twickenham with Hanworth and Kempton Park, Isleworth with St. Margaret's—all dependent, of course, on the probably strong opposition of some of the local authorities being overcome.

The corporation of Ayr, Scotland, a town known to the whole world as the birthplace of Robbie Burns, has decided that in equipping its power house it is entirely unnecessary to go outside of Scotland, and has therefore placed a contract for two 200-kw P. P. P. lighting and traction generators, coupled to Belliss engines, with the energetic young firm of D. Bruce Peebles & Co., of Edinburgh. This firm has now on hand a very large number of machines for power and tramway work, and has achieved a most marked success in the few years it has turned its attention to electrical work.

The corporation of Liverpool is making rapid strides with the equipment of its fine system of electric tramways, and by the end of the year will have in operation about 100 miles of route. As an object lesson to other cities contemplating electric traction, the history of Liverpool should not be lost, as when the first lines were laid down the opposition to the overhead trolley was intense. Now the contractors and the corporation can hardly keep pace with the demand, and the popular cry is for electric traction. Mr. Bellamy's plan of having a reversed staircase on the cars has also proved most popular, and enables passengers, even when old and decrepit, to ascend and descend from the top part without fear of accident when the car is in motion. One interesting feature about Liverpool is the fact that their power stations provide current both for the tramways and electric lighting, which might be called the English method, in contradistinction to Glasgow, which has adopted American ideas in its tramway practice, and has separate stations for tramway power and for its lighting supply. The Liverpool corporation has about completed its two new power houses of 12,000 hp each, which are equipped with Willans engines directly coupled to Siemens dynamos of 550 volts and 1450 amps. capacity. The two cities, therefore, of Liverpool and Glasgow will form interesting subjects of comparison when the proper time comes, and are thus more than ever rivals.

Arthur Ellis, who was recently appointed electrical engineer to the city of Cardiff, has made an elaborate report on the necessities of that city for electric traction, which has been adopted by the Cardiff Council. After dealing with the probable site of the new works, Mr. Ellis recommends vertical, compound, direct-connected, slow-speed engines, with water-cooling towers, economizers and mechanical stoking and ash handling. A. C. S.

Melbourne Report

The twenty-seventh annual report of the Melbourne Tramway & Omnibus Company, which was that for the year ending June 30, 1900, was presented to the stockholders at a meeting held Aug. 14. The tramway system of Melbourne, which is largely cable, was built by a tramway trust, representing the various municipalities interested, with money borrowed for the purpose and amounting to £1,650,000. The Melbourne Tramway & Omnibus Company rents the system, paying therefor a sum equal to the interest on this amount; also an additional sum for a sinking fund on the loan. The company supplies all its own rolling stock, car houses, etc. The population of Melbourne and the suburbs served by the system is about 450,000.

The report follows:

INCOME

Balance forward from last year	£30,419	10	5
Receipts from other sources	1,663	4	0
Interest	9,547	4	9
Traffic receipts	415,023	13	1
	£456,653	12	3

EXPENDITURE

Expenses of tramway trust	£905	11	8
Feed	4,319	8	1
Fuel	10,085	3	9
Licenses, rates, insurance, law costs, etc	14,083	4	4
Salaries of staff, and directors' and auditors' fees	16,708	17	10
Repairs and maintenance of cars, buildings, ropes and lines	73,506	14	6
Rating on tramway lines	7,087	11	0
Stationery and office expenses	4,200	3	2
Wages	110,588	11	10
Depreciation of leaseholds	2,175	9	6
Tramways' debenture interest	76,050	0	0
Tramways' debenture sinking fund	34,200	0	0
Tramways' renewal reserve account (of which £8,102 3s. 2d. was interest earned)	15,157	15	9
Dividends	38,400	0	0
To apply in reduction of properties	10,000	0	0
Carried forward as capital reinstatement account	10,000	0	0
Carried forward	29,185	0	0
	£456,653	12	3

Communication about Car Truck Patents

PHILADELPHIA, Oct. 24, 1900.

The Peckham Motor Truck & Wheel Company has stated in the *Street Railway Review* of the issue of Oct. 18, 1900, that the result of the interference proceedings in the patent office between G. M. Brill and C. F. Uebelacker, in relation to short wheel base trucks, was that "Mr. Uebelacker was awarded a patent for his specific claims, and Mr. Brill one for his, both being awarded patents."

This statement is true to the extent that Mr. Uebelacker got his patent on specific details; but otherwise it is absolutely untrue. On the contrary, the interference was decided in favor of Mr. Brill, and priority of invention was awarded to him.

The following is the decision of the patent office:

"Limiting Uebelacker to July 15, 1897, for his date of conception of the invention in issue, it appears that his statement fails to overcome the *prima facie* case made against him by the respective dates of filing applications.

"Judgment, therefore, on the record of priority of invention is hereby rendered in favor of George H. Brill, the senior party.

"WALTER JOHNSON,
"Examiner of Interferences."

No appeal was taken from this decision, and it has never been disturbed in any manner whatsoever.

This decision was made May 4, 1899, and the patents in suit in the North Jersey Street Railway case, which Mr. Peckham says his company is defending, were issued to Mr. Brill on June 27, 1899. The North Jersey suit was begun July 17, 1899.

That Mr. Peckham acquiesced in the decision of the commissioner of patents is clear from the following extracts from papers filed in these interference proceedings, and signed by his attorney, who was also his attorney in the North Jersey suit, viz.:

"These parties (Brill and Uebelacker) show a broad subject matter. Brill claims this subject matter and Uebelacker limits his claims to a specific embodiment. The issue as defined had for its object to determine which of the parties was entitled to priority of invention concerning the broad subject matter. * * * He (Brill) is entitled to his broad claims." * * *

Again, over Mr. Peckham's same attorney's signature in that proceeding appears the following: "So far as regards any generic feature of the invention, Brill is the first inventor. I have not contested that."

In one of the final decisions rendered in these same proceedings the commissioner of patents stated as follows: "Uebelacker can be allowed only such claims as are patentable over Brill's device. [That is, subject to Brill's prior invention.] A decision on priority makes the successful party's invention a part of the prior art in so far as his opponent is concerned, to the same extent that it would be if shown in a prior patent. It is, if anything, a better reference, since in regard to certain matters the defeated party is estopped from disputing its pertinency."

The Peckham Motor Truck & Wheel Company was the assignee of the Uebelacker application in the patent office; prosecuted these interference proceedings on it, and was the real party in interest; and the Uebelacker patent was issued to it as the assignee of Uebelacker.

This would seem to dispose of Mr. Peckham's contention that the Peckham Motor Truck & Wheel Company was the "originator" of the type of truck known as the Brill 27-G, or of any "short wheel base" pivotal truck.

J. G. BRILL COMPANY.

The Sprague Multiple-Unit Patents

After pending for more than two years there were issued on Oct. 16, 1900, two patents, which have not only been already watched with great interest by the electrical and railway world, but which bid fair to become a most important feature in the development of heavy electric railroading. The patentee, Frank J. Sprague, has long been known as a distinguished inventor, and the system for which he has secured protection has proved in practice to solve that most important question, the running of electric trains without a locomotive.

The system actually employed, as stated in the specifications, is electrical, and includes all the apparatus for controlling the speed, direction of revolution, and grouping of the motors. In all, the remarkable number of 263 claims are allowed. The explanatory part of the patent consists of an elaborate and really impressive discussion of the invention, occupying some twenty-two pages, and describes in the most complete manner the twenty sheets of drawings which precede it. A few of these latter are shown on this page. It is impossible at this early date to say which will be the most important features or upon which the greatest amount of litigation will hinge, but the drawings selected for reproduction seem to be of such a general character that they probably contain most of the salient characteristics. Fig. 1 is a plan of a car, showing the installation of a complete equipment of the multiple-unit system. Figs. 2, 3 and 4 represent diagramatically the various connections for open circuit and forward and backward running. The same difficulty obtains in the attempt to make judicious selection of the claims as in that of the drawings. The last one is phrased in the following sweeping terms: "An electrically-equipped train having independent direction and speed-controlling circuits, substantially as described." A few of the first ones run thus:

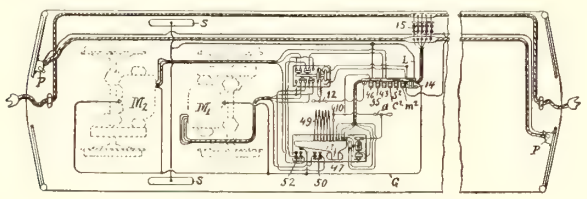


FIG. 1.—MULTIPLE-UNIT SYSTEM

1. In an electrical train system, the combination of translating devices and circuits therefor in parallel relation with each other, and a governing train line independent of the other circuits, substantially as described.

2. In an electrical train system, the combination of translating devices, circuits therefor, and a governing train line independent of the other circuits provided with sets of controlling wires, substantially as described.

3. In an electrical train system, the combination of motors, circuits therefor, an independent governing train line consisting of two sets of train wires, one set for determining direction and one set for speed regulation, substantially as described.

4. In an electrical train system, the combination of motors, circuits therefor, an independent governing train line consisting of two sets of train wires, one set for determining direction and one set for speed regulation, suitable contacts controlled by these wires, and means for holding closed the direction-controlling contacts, and means for opening and closing the contacts for regulation at will, substantially as described.

5. In an electrical train system, the combination of translating devices and circuits therefor in parallel relation with each other, a governing train line independent of the other circuits, and relays connected with the governing train line in parallel circuit with each other, substantially as described.

6. In an electrical train system, the combination of motors, circuits therefor, controllers therefor, and an independent governing train line with relays for operating the controllers, substantially as described.

Among the others are found the following:

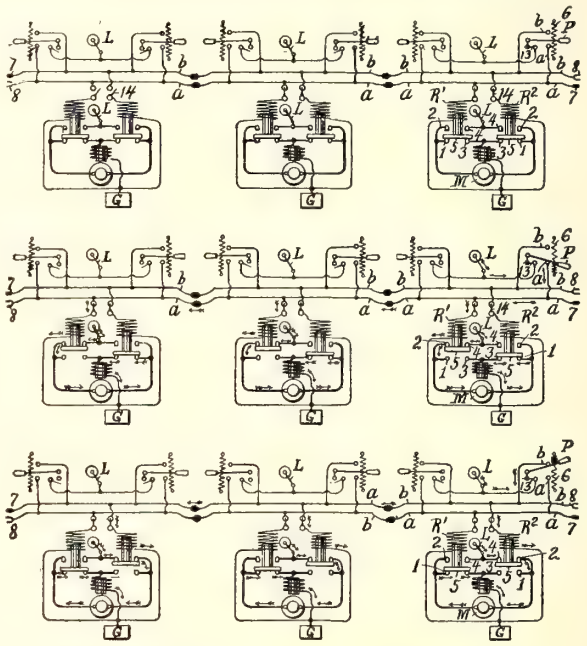
A car equipped with a motor to drive it, a controller for the motor, a relay-circuit including a train-line for operating the controller, and one or more operator's switches connected with the train-line, substantially as described.

In an electrical train system, the combination of motors, circuits therefor, controllers for the motors, and a governing train-line which is independent of the motor-circuits, relays connected with the governing train-line in parallel with each other for operating the controllers, and means for energizing the governing train-line, substantially as described.

A train with a plurality of cars, a governing train-line through the cars, one or more operator's switches connected to the train-line, and motors on one or more of the cars connected with the source of supply through contacts controlled through the train-line, but otherwise independently thereof, substantially as described.

A train with a plurality of cars, a governing train-line through the cars, one or more operator's switches connected to the train-line, and motors on one or more of the cars connected with the source of supply through reversing-contacts controlled through the train-line, but otherwise independently thereof, and independent means for connecting the motors in series and multiple and for varying the resistance in circuit therewith, substantially as described.

In summing up his description of principle and methods, Mr. Sprague says: "The practical result of the system developed in the foregoing specification and in the drawings illustrating it when applied in its entirety is that cars properly equipped can be made up interchangeably into a train of any length and can be operated from any one of a number of points, and that all an operator has to do in order to effect definite movements of the train as to acceleration, speed and direction is to make movements of his hand at any one of the operator's switches, which will be similar under the conditions that usually arise in practice. In short, a car is a unit, and a train composed of a number of similarly equipped cars is also a unit having the same general characteristics that a single unit has, preferably without any conditions being imposed as to the number, order or



FIGS. 2, 3 AND 4.—MULTIPLE-UNIT SYSTEM

end relation of the units comprising the train. The same general statement applies to the operation of a train made up of cars some or all of which are but partially equipped, but which together are provided with an operative train equipment. To effect this fundamental result practically, it has been necessary to provide for properly connecting the cars, preferably independently of sequence, number and end relation, with couplings of such character that any train hand can effect the coupling; to provide against cross connections in the circuits on the different cars; to guard against accidents due to failure of circuits or current or otherwise; to secure practical uniformity of operation in the apparatus on the different cars and equality of work in the various motors, and to secure simplicity and flexibility in the relation of the parts under all the various conditions of operation. To accomplish this, a system has been devised which is in part automatic, and includes two sets of circuits, by means of which all or part of the apparatus on the various units or for the various equipments is operated through local means whose action is initiated through a governing line and master controllers, whatever the nature of the intermediate apparatus or the specific construction of the controlling apparatus. In the numerous claims herein presented it has been attempted to cover as fully and broadly as possible those characteristics of the system which are required to render the fundamental conception possible of accomplishment or which are of advantage in point of commercial economy, efficiency, or safety. It is obvious that partial advantage may be taken of this system without adopting it in its entirety, and that the various elements can be greatly modified without losing the advantages gained by the fundamental combinations, systems and methods of operation. Many changes can be made without departing from the spirit of my invention."

CURRENT NEWS

English Deal for the Purchase of the Denver Tramways Off

W. G. Evans, secretary of the Denver Consolidated Tramway Company, returned from a trip abroad during the latter part of October. It was thought that a sale of the Denver Tramway property would be effected during Mr. Evans' stay abroad. He announces, however, that no immediate sale is contemplated. The option held by the English syndicate has expired, and the deal is off.

Experimental Freight Lines in Washington

The Washington Traction and Electric Company has established a freight service on two of its lines with a view of ascertaining the possibilities of such service if generally adopted. A freight department has been created, and T. F. Alvey has been placed in charge of the department. At this season of the year, however, the supplies of country produce coming into the city are not so large as they were during the summer, but thus far the service already established by the company on the two lines mentioned has demonstrated the fact that this city is a base of supplies for the sections of the outlying territory referred to. Quite a business has already been developed, and the outlook is promising.

No Jim Crow Cars in New Orleans

A lively debate ensued at the meeting of the New Orleans Council, held October 23, to consider the Stanley ordinance providing for the separation of whites and blacks in the street cars, and the ordinance was defeated. The general opinion was that the passage of the ordinance would do away with the hoodlum element, which was especially desired; but on the other hand, however, it would only tend to intensify the present race hatred. Would the white man, who was in a hurry, allow a "Jim Crow" car to pass and bide his time till a regular car should appear? The general opinion was that he would not. If he should board the car, then there was a possibility of an eruption. Then, again, there were men of the laboring class who worked side by side with negroes all day. He desired to reach his home as expeditiously as possible, and what harm if he rode home in the car with the man with whom he had been in contact all day? One councilman held that the street railway companies had a contract with the city, and it was hardly fair to impose on that contract; also that the ordinance was an attack upon the railway companies, and would affect the city's credit.

Inducing the Extension of Electric Lines

In Westmount, Que., a suburb of Montreal, is found a striking example of a town which fully appreciates what the construction of a suburban line means. This town has decided to pay the Montreal Street Railway Company the sum of $2000 a year for the construction of a line connecting it with Montreal, and it has granted the company the free use of the village streets. The action of this town is in striking contrast with that of many suburban towns in the United States, who, the moment a franchise is sought by a company of another city, argue that the trade of the town will at once be transferred to the city, and that the advent of the electric railway will work to a hundred and one other harmful ends. With these thoughts uppermost in their minds, the village authorities are wont to place the heaviest restrictions on companies seeking entrance, and in many cases such companies invariably decide to abandon the contemplated extension. It is hardly to be expected that capitalists building a line, which will probably be operated at a loss for the first few years, will start out weighed down with heavy franchise obligations. The suburban extension does not, as a rule, prove remunerative for the first few years, and it is only after the advantages of the towns and the excellent means of transportation afforded have been brought to the attention of the city dwellers, that the town strikes a "boom." After this has taken place the company begins to realize on the large outlay of capital in constructing the line. Then as the town grows the company profits. Not only does the company profit, but the town itself has also been a beneficiary. In place of the little suburban town, which a few years before contained one or two stores, with a corresponding number of residences, evidence of metropolitan activity are to be found on all sides. It is fallacious for the suburban towns to retard the construction of electric lines by imposing heavy obligations at the inception of a projected line.

Inspection of the Toledo, Fremont & Norwalk Railway

A number of the officials and invited guests of the Toledo, Fremont & Norwalk Electric Railway made a trip of inspection over that company's road on October 24. The party was carried over the entire line and then inspected the power house. An elegantly appointed banquet in the Fremont House, at Fremont, was one of the principal features of the trip. This was arranged under the direction of General Manager Stout, of the company. Speech-making, in connection with the dinner, was rather informal, and the prevailing sentiment was one of congratulations to S. F. Angus and Henry A. Haight, who promoted the road, and to the Comstock Brothers, of Detroit, who financed the line. Among those who participated were the following: President S. F. Angus, Vice-President W. B. Comstock, Treasurer A. W. Comstock, Secretary W. A. Comstock, General Counsel Henry W. Haight and General Manager F. J. Stout, of the company; F. W. Walker, of Westinghouse, Church, Kerr & Co.; A. E. Lang, president Toledo Traction Company; W. H. Churchill, of the Westinghouse Company; H. C. Hutchins, president of the Detroit Citizens Railway Company, and J. C. Riley, president of the Rapid Railway, of Detroit.

Club Houses and Merit System at Chicago

It is a notable fact that the presidents of the two largest street railway companies of the United States, the Metropolitan Street Railway Company, of New York, and the Chicago Union Traction Company, who are both self-made men, are making special efforts toward the welfare of employees and striving to come into closer personal contact with the men and cultivate pleasant relations between the employees and the company, and so between the public and the company. President Vreeland's efforts in that direction in New York are now well known. President Roach, of Chicago, is working along on the same principle as Mr. Vreeland, and last week announced his intention to build two club houses, one on the West Side, at Madison Street and Fortieth Avenue, and one on the North Side, at Lincoln and Wrightwood avenues. The entire expense will be assumed by the company. Mr. Roach hopes to make these clubs the social centers for the employees and their families, with reading-rooms, theatricals and entertainments as an attraction. In connection with this it is intended to have a system of instruction which will help to a thorough training of the men for the duties they were called to perform. Another innovation decided upon by Mr. Roach is a percentage merit system, the details of which have not been worked out, but which in general will consist in a system of credits whereby those falling below a certain standard will not be retained. The system developed by Mr. Roach will be of considerable interest. A percentage merit system has been in use for several years on the Metropolitan West Side Elevated Railroad, of Chicago.

Increase of Wages in Denver

The directors of the Denver City Tramway Company have decided to increase the wages of their employees, and have fixed upon a schedule of 18½ to 24 cents an hour, the amount varying according to the term of service. Some little time ago the employees of the company petitioned for an increase, but the matter was not settled until recently, owing to a number of the directors being out of the city.

Milwaukee Company Upheld by the Supreme Court

The Supreme Court of Wisconsin on Oct. 12, in the Milwaukee street railway case, reversed the lower court and thus upheld the 4-cent fare ordinance and the extension by the Common Council of the street railway company's franchise. With this decision comes the end of the famous street railway suits that resulted from the granting of the 4-cent franchise last January. The opinion, which is by Justice Winslow, is based upon the discretionary power of the Common Council, as granted in the city charter, to determine what shall be for the best interests of the citizens as a whole, the

Supreme Court holding that this power is absolute and cannot be questioned in any court, so long as no wilful waste or squandering of public property, rights or funds can be shown.

Regarding the $100,000 offer by an independent company, the court ruled that this was also a matter entirely within the discretion of the Council, and that it may have acted wisely in refusing it, because a new company would find it almost impossible to give as complete and thorough a service to the citizens as the established one. The Supreme Court holds that the franchise is valid, and that the street railway company may proceed with its line extensions, which will require an expenditure of more than a quarter of a million dollars at once. The decision broadly sustains the validity of all street railway franchises in the State of Wisconsin, and its effect is the protection of millions of dollars of capital that has been invested in reliance upon these franchises in scores of cities in the State. On every point raised the Supreme Court ruled in favor of the street railway side of the case.

Attorney George P. Miller, with Charles Quarles as counsel, presented the matter to the Supreme Court for the street railway company, and Attorneys W. H. Timlin and John S. Toohey appeared for the defendant.

The history of the litigation is quite an extended one. On Jan. 2, 1900, the Common Council of the city of Milwaukee passed an ordinance which granted to the Milwaukee Railway Company the right to operate street railways upon certain streets in the city, and also extended all the existing railway franchises, already owned by the railway company upon other streets in the city, and required the railway company to file a written acceptance of the grants so made within thirty days. In consideration of this the company agreed to sell twenty-five tickets for $1, good for transportation during certain morning and evening hours.

On Jan. 5, 1900, a citizen named J. G. Trentlae commenced an action against the railway company and the city for the purpose of restraining the railway company from filing its acceptance of these grants, and the city officers from receiving such acceptance and preventing the railway company from laying street railway tracks and operating a street railway upon First Avenue, in this city, this avenue being one of the streets covered by the grant.

Trentlae claimed that the franchise was of great value and that large amounts of money had been offered for them, but that they had been improvidently given away by the city by the ordinance and resolution without any remuneration, and that the city had no right or power to grant the franchise without consideration; that the money which the city might and could obtain for the franchise was thereby lost to the city, etc.

The court took the broad ground that the offer of the 4-cent fare was a consideration, and that the city authorities were the only ones authorized to judge whether it was adequate. That they so concluded settled the question, unless there was a manifest squandering of the city's property, and this does not seem to be the case.

Column Type Measuring Instruments

Frank W. Roller, of the firm of Machado & Roller, gave a very interesting talk upon the Whitney column type electrical measuring instruments after the reading of the paper at the meeting of the American Institute of Electrical Engineers on Wednesday, Oct. 24. These instruments, of which Machado & Roller are the New York agents, were described in the columns of the Street Railway Journal a few months ago. Mr. Roller had various styles of instruments on exhibition, and the members of the Institute were allowed to examine their operation most thoroughly.

Investigation of Electrolysis from Railways in Germany

Early this year the Street Railway Journal reported on the appointment of a commission by the Elektrotechnische Verein of Germany, which was to investigate the earth-return currents on electric street railways. This commission sent out the following questions, working in conjunction with the Verein Deutscher Strassenbahn und Kleinbahn Verwaltungen, to the owners of electric roads and to city gas and water works, to determine whether and to what extent these return currents have affected the gas and water pipes or other underground metallic structures:

(1) How long has the road been in operation—*i. e.*, with electric service?

(2) Length of road?

(3) Plan of route, with location of cars drawn in and a statement as to the maximum observed current consumption?

(4) Car-kilometers per year?

(5) Total energy consumption in kilowatt-hours per year?

(6) Maximum current used at any time?

(7) Maximum calculated current in the original specifications?

(8) Maximum loss of voltage in the rails as calculated in original specifications?

(9) Maximum observed loss of pressure within the interior of the city, locating the places of observation?

(10) Special details in regard to the returns: (*a*) What section of rail? (*b*) What kind of rail joints? (*c*) Is the rail supported on insulators, and of what kind? (*d*) Are bare or insulated rail-feeding cables laid parallel to the rails? (*e*) Are cross connections used between the rails, and what distances apart? (*f*) Are earth plates used? (*g*) Is the track electrically connected with the water pipes?

(11) Are there several electric roads in the city, and are the systems electrically connected?

(12) (*a*) Is the current supplied by one or more stations? (*b*) Do the stations also furnish current for lighting, power or other purposes?

(13) With what pole of the generator are the rails connected?

(14) Are regular measurements made during the service of (*a*) the track resistance and earth resistance? (*b*) difference of potential between earth and different points on the track, between track and gas pipes, track and water pipes, gas and water pipes and lightning-rod plates? In answering these questions actual measurements are requested.

(15) How large are the earth differences of potentials when the cars are not in operation?

(16) Have you noticed electrolytic disturbances on rails, cables, gas and water pipes? What has your experience been?

(17) (*a*) Is your road blamed for such electrolytic disturbances? (*b*) Or has it been shown that the disturbances were due to some chemical action between pipes and soil?

(18) Does the soil show any characteristic chemical constituents such as acids and alkalies?

(19) What is the mean ground water level on the main lines?

Conclusions.

In addition to the above, four questions were submitted to the owners of gas and waterworks, and answers were received from forty gas works, twenty-five waterworks and eight gas and waterworks. Eight cities report corrosion of gas and water pipes and covering of light cables, but it is questionable whether all of this is due to stray electric railway currents. Three cases can be traced to defective electric light circuits and the other five are not of a very serious nature. This report is very encouraging, in view of the fact that seventy companies replied to the questions. In short, out of the ninety German cities which possess electric roads only two or three have to report corrosions which are to be ascribed to earth-return currents, and these took place where the current density was very large. The replies further show what means may be adopted to prevent such disturbances. The commission has begun to compile a list of rules and regulations for the prevention of such disturbances, which will be published in our columns as soon as issued.

PERSONAL MENTION

MR. RALPH D. MARCHAND, expert for the Westinghouse Company in long distance transmission, has been appointed to a similar position with the Montreal Street Railway Company and the Chambly Manufacturing Company.

MR. G. F. GREENWOOD, chief engineer and general manager of the Havana Electric Railway Company, of Havana, Cuba, and formerly of Pittsburgh, was in New York Oct. 26. Mr. Greenwood will remain in the United States about two weeks.

MR. EUGENE S. REILLY, general manager of the West End Traction Company, of Pittsburgh, has recently returned from Europe, where he visited the Paris Exposition. On his return to Pittsburgh Mr. Reilly was tendered an informal dinner by the office force of the company.

MR. JOHN FRANCIS COLLINS, superintendent of the Toledo Traction Company, celebrated his seventeenth anniversary as a street railway superintendent recently. Superintendent Collins began his railway career in Indianapolis in 1884, and later he became night superintendent of the system in that city. In 1898 he was appointed superintendent of the Toledo Traction Company.

ENGINEERING SOCIETIES

ENGINEERS' CLUB OF PHILADELPHIA.—A regular meeting of this club will be held Saturday, Nov. 3. The paper entitled, "American Isthmian Canals," will be discussed.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

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Antiquated Horse Cars in Cleveland Parade

As a feature of the Republican parade at Cleveland, Nov. 3, the Cleveland Electric Railway Company resurrected two horse cars which had not been in use for many years and placed them in operation on Euclid Avenue between the Public Square and Erie Street. Banners on the cars said: "Style of 1860. Think and Thank." Through the daily papers the public were invited to "Come and have an old-time ride. No fares collected." The cars were operated by four men who had been in the company's employ for nearly twenty years.

Three-Cent Fare Suit in Massachusetts

The city of Worcester, Mass., has instituted suit against the Worcester Consolidated Street Railway Company for refusing to issue 3-cent fare tickets to school children, and carry them at that rate as stipulated in the recent act of the Legislature. The law specifies that all school children shall be carried for one-half the regular fare, and that tickets shall be sold them in books of ten. The penalty fixed in the statute for failure to comply with the law is a fine of $25 in each case. This suit will be followed with great interest, as it is really instituted to test the constitutionality of the act.

Comments of a Daily Newspaper on Trolley Accidents

The *Boston Herald* appears to be one of the very few newspapers —and they are very few—which realize what the management of a street railway property means, and the comments in its issue of Nov. 3, which are very timely, are given below:

"Two cases in one day of trolley cars being uncontrollable serves to show that accidents in this means of transportation are always possible. On the whole, considering the great number of these vehicles employed on the city streets and the suburban roads, the number of serious accidents reported is few, and this way of locomotion must be considered remarkably safe. It is apparent that safety depends all the time on the proper working of the machinery, and on the skill and attention of the motormen in charge. Doubtless there are many cases of the failure of brakes to work as they should, of which nothing is known by the public at large, because no consequences follow that require the attention of reporters. There are also narrow escapes due to the carelessness of operators of which no mention is ever made. But when a car runs into a draw, or dashes upon the sidewalk, or has a collision that results in injuries, the facts come to the knowledge of the public. It is vain to expect that all such accidents can be eliminated from experience. Yet, when all is said, the general safety of the trolley system is a matter of gratification and of admiration as well."

Connecticut's Annual Railway Report

The annual report of the Railroad Commissioners regarding the condition of the street railways of Connecticut has just been made public. The report is, from every point of view, a satisfactory one, and shows more remarkable gains than last year throughout the State.

The companies making the largest returns in order of size are: Hartford Street Railroad Company, Fair Haven & Westville, Bridgeport Traction, Connecticut Lighting & Power Company (Waterbury district) and Winchester Avenue. The greatest number of passengers carried per mile, showing the most heavily patronized roads, are the Montville Street Railroad Company, 7.68 passengers per mile; Norwich Street, 5.98; Danbury & Bethel, 5.85; Derby Street, 5.71; New London Street, 5.48; Winchester Avenue, 5.16. During the year there were 39 people killed by the electric roads and 178 injured, against 12 last year killed and 312 injured. The year has, therefore, been freer by 134 in accidents and has increased 27 in deaths. During the year there has been an increase of but 4 miles in new trackage in the State up to June 30. Stock issues have decreased $600,000; bond issues decreased $10,000; cost of construction decreased $600,000; cost of equipment fallen off, $10,000; gross earnings increased, $257,000; operating expenses, $100,000; net earnings, $143,000; dividends have decreased $21,000; interest has increased, $3,000; taxes have increased $24,000; miles run increased 1300; passengers carried increased 5000; the average passengers per mile run have decreased from 4.05 to 4.02; number of employees decreased, 365.

Mr. Louderbach as Mr. Yerkes' Representative

D. H. Louderbach, of Chicago, is now en route to London to take charge of the Charing Cross, Euston & Hampstead Railroad, in which C. T. Yerkes and other American capitalists are interested. He will be the personal London representative of the American syndicate, and will assume the direction of the work immediately on his arrival. Mr. Louderbach was in London with Mr. Yerkes when the deal was completed, and has been associated with Mr. Yerkes in his Chicago enterprises. He supervised the erection of the Union Loop, and also had charge of many of the outlying suburban lines now merged into the Consolidated Traction Company.

No Third Track for Lake Street "L"

The following paragraph appeared in a recent issue of a Chicago daily newspaper, and also found its way by special telegraph into many of the important dailies in the principal cities: "The Lake Street Elevated road is planning to build a third track in connection with its system and will open an express service similar to that in vogue on the Northwestern line. Express trains will be run downtown in the morning from the outlying stations, and from the city to the western terminus during the rush hours of the evening. By this means accommodations can be provided for patrons in the busiest hours." Such news as this naturally caused much talk in engineering circles. A representative of the Street Railway Journal called on Mr. Abel, president of the company, and he emphatically denied that the company was considering any such move.

Trolleys Crash in Montreal

A score or more people were injured in a collision which occured on Cote des Neiges hill, Montreal, on Nov. 3. There was a pilgrimage to the Cote des Neiges Cemetery on this date, which was attended by several thousands, and as a car, loaded to its full capacity, was ascending the hill, the trolley slipped off. The motorman applied the brakes, but the car slid backward slowly. There was a panic among the people inside the car, and they made a rush for the front vestibule. So many crowded in that the motorman was rendered powerless to do anything further. They broke the vestibule windows, the windows of the cars, and jumped from the rear platform. The car, gathering speed, dashed into a car following and that one crashed into another, before all were finally brought to a standstill.

Chicago Commission Prepares Bills to be Presented to the Legislature

The Chicago Street Railway Commission has practically completed its report to be presented to the Council, and the bills to be presented to the Legislature. It is planned to present two bills to the Legislature, and, before they are finally ready for presentation, they will be presented to the city's legal experts for their opinion. The first measure will be one conferring upon the city authorities the specific right to own and operate street railways. Under its provisions the city will be empowered to negotiate for the purchase of the present street railway plants within the city limits, or, as an alternative, to build an entirely new system. The money for thus purchasing or building street railways to be owned by the municipality is to be raised by the issuance of bonds within specified limits. Before such bonds can be issued the question must be submitted to a vote of the people. The second measure provides for municipal ownership of a comprehensive system of downtown subways. It has the same provisions as the other bill as regards the financing of the subway system. It confers authority upon the municipality to build the subway system on a bond issue, and, like the other bill, makes an affirmative popular vote necessary before such bonded debt can be incurred. The net result of the municipal street railway commission's labor is thus the adoption of the principle of municipal ownership, and at the same time the adoption of the referendum principle.

New Superintendent in Denver

The directors of the Denver Consolidated Tramway Company have appointed Simeon W. Cantril superintendent, to succeed C. K. Durbin, resigned. The appointment comes in the way of a promotion, as Mr. Cantril has been superintendent of the South and West divisions of the tramway system since December last. Although still a young man Mr. Cantril is an old resident of Denver, and has held such positions that he possesses an unusually extended acquaintance in the city. He first became known to the public as chief deputy United States marshal in Denver, in which capacity he served eight years. Later he was chief deputy in the Assessor's office, after which he was connected with the Denver Gas Company for four years. At the end of that period he had his first experience in street railway work as assistant to the superintendent of the Denver Cable Railway, and in December last he became connected with the Denver Tramway as division superintendent.

The Relative Advantages of Narrow and Standard Gages for Electric Roads *

BY F. GUNDERLOCH, MANAGER OF THE BERGISCHE KLEINBAHN GESELLSCHAFT

This report considers the following question: What are the relative advantages and disadvantages of narrow gage and standard gage for electric street railways, especially in regard to the mounting of sufficiently heavy motors and other mechanical appliances?

On account of the greater efficiency of electric motor cars, the strictly city street car lines have been extended into suburban districts, which naturally present new problems for solution. One of these is the demand for higher speed and the accompanying necessity for heavier and stronger cars. The greatly varying traffic further made it necessary, at certain hours, to run trains consisting of a number of cars. The motor cars must possess sufficient weight for traction and be equipped with motors which can furnish the requisite draw-bar pull. In general, care must be taken in projecting an electric road so to build it that it can extend in the future, and new requirements be met without difficulty.

An important role in this connection is played by the choice of the right gage. As gages of less than 1 m are seldom met with, this paper only compares the meter gage with the standard gage. Only eleven companies sent replies to the above question, and from these the following general conclusions have been drawn:

1. The narrow gage permits an easy rounding of sharp curves. With the present types of motor cars, with a wheel base of from 1.6 m to 2 m, this advantage is not a very important one. It has been found that of sixty-one electric roads having curves of 20-m radius or less, thirty-three employ the standard gage and only twenty-eight the meter gage. This shows that the occurrence of a few sharp curves should not be sufficient cause to induce railway companies to adopt the narrow gage.

2. There is less expense connected with the construction and maintenance of a narrow gage than standard gage. This, of course, only becomes of importance where the company builds its own roadbed, and where the same is of considerable length. The narrow gage requires a smaller expenditure for roadways, the transportation of earth and general construction.

3. As the electric roads are feeling more and more the competition with steam roads, especially in the transportation of freight, it is to their advantage to use the standard gage, as it enables the electric freight cars to traverse the tracks of the steam road, thus saving the cost of unloading and vice versa. To permit this the following conditions, however, must be observed in the building of the street car line:

(a) There must be no curves of a radius less than 150 m.

(b) The rails must be so supported that they can resist at any point a moving load of 6000 kg at a speed of 30 km per hour.

(c) There must be a clear space above the track of 760 mm.

(d) The track axes must be 4 m apart.

(e) There must be no grades which would overload the motors for too long a time.

(f) Such brakes must be installed and such a speed must be chosen on public highways that the train can be brought to a stop within the distance required by law.

It is worthy of note that a number of original narrow-gage roads, in order to become more serviceable, have changed over entirely to the standard gage, or have laid a third rail.

4. As the motors are mounted between the wheels of the motor car, it is evident that larger motors can be installed on standard-gage cars than on those built for narrow gage. To compensate for this difference, it is often necessary to equip narrow-gage cars with two motors, which entails a considerable expense. It has the

* Abstract of report read before the International Tramway Congress, Paris, September, 1900.

advantage, however, that if one motor should break down the other one will still be able to propel the car. Besides, a two-axle car more evenly distributes the weight and starts with less jar than a single-axle car. Furthermore, two motors and a series-parallel controller permit of a better regulation of speed. It is also possible to attach a trailer to a motor car equipped with two heavy motors, or even attach a freight car during those hours when passenger traffic is light. To do this same work on a narrow-gage road, four-axle cars with four motors must be employed, which necessitates a considerable expense. It is also more advantageous to use larger motors running at a slower speed with the armatures mounted directly on the wheel axles and so avoid the use of reducing gears. Such motors can only be used on standard-gage cars.

5. The use of large motors on narrow-gage cars takes up all the room between the wheels. Thus the accessibility to the various parts is made more difficult, which is a great disadvantage. The motors are further exposed to a greater extent to the water thrown up from the track during travel, as the space beneath the motors is too small to allow for the provision of proper guards.

6. The small space also forbids the mounting of air pumps for the use of air brakes alongside of the motors, and in any case the arrangement of the brake mechanism is less convenient on narrow gage than on standard-gage cars, on account of the crowded condition between the wheels.

7. The standard-gage cars are also more stable than narrow-gage cars. In the latter cars with longitudinal seats the wheel boxes become very objectionable.

8. In conclusion, a few remarks should be addressed on this subject to the owners and maintainers of highways who are in the habit of advising the railway companies to build narrow-gage roads because they take up less room than those of standard gage. This is an erroneous idea, however, as experience has shown that other vehicles will not use the narrow-gage tracks, but travel alongside, and thus take up a great deal of valuable space on the roadway. As the narrow-gage cars have the same width as the standard gage ones, the space taken up by them is the same. There will, furthermore, be fewer collisions between vehicles and cars on broad-gage roads, as the former are kept further away from the gage line.

From the above it will be seen that for electric street railway service the standard gage possesses many advantages, and is more commonly employed. I should not recommend the change to the narrow gage, which would exclude the possibility of running street cars over steam railroad tracks.

The Falk Cast-Welded Joint*

BY J. FISCHER-DICK, ENGINEER OF THE GROSSE BERLINER STRASSENBAHN

This paper is based on replies received to the following questions sent to the members of the association:

Have you used the Falk rail-joint, and with what success?

When did you introduce the joint?

On what length of track was it used, and what form of rail section?

What technical reasons led to its adoption?

Did you use it on new track or old track, so as to avoid the renewal of the latter?

What special reasons can you give to justify the great expense of such an installation?

What was the cost per joint of road and pavement work, of the cleaning of rail ends, wages for casting the same and the molten metal? How large a royalty must be paid, and what other expenses are there?

What installation and material are required as regards cost and quantity?

How large a proportion of the cast joints broke?

Did the breaks occur at certain periods of the year?

How long after the joints were cast did the breaks occur?

How great a length of track could be thus welded without fear of trouble from expansion and contraction?

Are you using rail-bonds in addition to the Falk joint?

Have you any further remarks to make?

These questions were answered by only two companies, the Grosse Berliner Strassenbahn and the Compagnie Générale Francaise de Tramways of Paris. Ten companies reported that they have not introduced the Falk joint. The Tramways Bruxellois submitted the questions to four American and four French companies and the replies have been advantageously utilized in the compilation of this report.

* Paper read before the International Tramway Congress, Paris, September, 1900.

The Falk patent is an American one, and was first used in November, 1894, by the Citizens' Railway Company, which has now used it on all its line (about 40 km up to 1899). The Chicago City Railway Company, the Twin Cities Rapid Transit Company and the Memphis Street Railway Company followed in 1895. The Chicago City Railway Company has placed inside of four years 40,000 joints on its 161 km of track.

In Europe the first company to use it was the Tramways de Lyon in 1896; the Compagnie Générale Francaise de Tramways of Havre and Marseilles followed in 1898, etc. The writer made a trip to Lyons in 1897, and the result was that during the winter of 1897-98 the Falk joint was introduced on the Grosse Berliner Strassenbahn. In Lyons there are 1700, in Rouen 1200, in Havre 6500, in Marseilles 6000, in Paris 2600, in Nice 3400 and in Berlin 7609 joints. In all cases the companies used the joint because they wanted an even, jarless track, a more durable track construction and reduced maintenance expenses.

The cost per joint varies according to the rail section, as the Marsillon rail (Lyons) requires less metal than the Phœnix rail (Berlin). The cost given by the Compagnie Générale Francaise is f.2030 per joint, without license and depreciation; f.15.60 at Havre; f.20.10 at Lyons, and f.16.50 at Marseilles.

The Twin Cities Rapid Transit Company, which has taken out license rights, places the cost at $2 per joint without including track repairs and cost of patent. This is for a 30-kg rail

The Berlin road paid Th. Smidt, the Falk representative, 20 marks per joint exclusive of road work, and now this price has been raised to 25 marks.

The following are a few of the replies received to the question: How much material is required to cast fifty joints? In Lyons, with twenty-five molds, clamps, etc., costing f.20.75 exclusive of furnace, 100 joints were cast in one night. The Chicago City Railways Company used a furnace, two wagons with six horses, thirty-five laborers, foremen, watchmen and inspectors, and cast 150 joints each night on 4-in. and 5-in. rails, ninety on 7-in. rails, and forty-five on 9-in. rails. The opening of the pavement, casting and repaving required one and one-half days. The Twin Cities Rapid Transit Company, in laying new tracks, cast from seventy-five to 100 joints in one day, employing fifty men. The Berlin company reports that the material for fifty 75-kg joints costs 400 marks.

The Citizens' Railway Company reports 1 per cent breakage, the Chicago City Railway Company ¼ per cent, the Twin Cities Rapid Transit Company no breaks in asphalt, but 5 per cent in macadam and ordinary pavement. The latter company puts a fish-plate joint at every 1000 feet. The Memphis Street Railway Company reports a ½ per cent breakage, the Tramways de Lyon ½ per cent, at Havre four breaks occurred on 3800 joints, at Berlin 1¼ per cent broke. In Berlin no fish-plate joints are used, while the Compagnie Générale places them every 250 m.

The breakage of joints in the mold is ascribed to careless cleaning of rail ends; the breakage later to rail contraction. At Berlin the latter was found to be from 35 to 50 mm for every 100 m of track. Only one break occurred in Berlin on joints laid in asphalt.

All companies speak in the highest terms of the usefulness and economy of the Falk joint when properly executed. Old, worn-out tracks have been made serviceable for many years to come With new tracks, noiseless running of cars is secured, and the tracks will last for a longer time. It should be stated that America leads in the extent to which the Falk joint is used, and in Europe France takes foremost place. Lately, however, the Goldschmidt rail weld is being tried by several roads, and the result is being watched with interest.

The shortening of the rail after the joints have been cast is still an unexplained phenomenon. It is also a remarkable fact that even during the hottest day no expansion of the rail can be observed. In building new track the contraction of the rails can be considerably reduced, but such is not the case with old rails. Furthermore, it was found that wherever a break occurred the rail contracted considerably, and fish-plates bolted at these places had soon to be replaced by longer ones.

The advantage of casting over welding is that the rail is only heated excessively at the web and foot in the first method, while in welding it is dangerously heated throughout the entire end where the weld is made.

A disadvantage of the Falk method appears to be the fact that it is not economical to cast as small a number as twenty joints, as the material in the furnaces is not all utilized. In Berlin, for example, the repairing is proceeded with simultaneously with the track construction, so that only eight to ten joints could be cast; which makes it entirely out of the question.

In conclusion it should be stated that the Falk joint has lightened the burdens of and removed the fears entertained by the railway engineer, and has become of great financial value.

The Milwaukee 4-Cent Fare Decision

Reference was made in the issue of this paper for Nov. 3 to the recent decision of the Supreme Court of Wisconsin in favor of the Milwaukee Electric Railway & Light Company, broadly sustaining that company in the franchises which had been awarded it by the Common Council. The decision is such an important one that it is given in full below:

RULING OF THE COURT

Winslow, Justice.—"With the somewhat novel practice followed in this case, by which a new plaintiff owning property on a distant street was allowed to be substituted for the original plaintiff, and the original injunctional order was permitted to remain in force practically without complaint for weeks, while the new plaintiff was preparing his complaint, we are not concerned. No question as to the propriety or regularity of these proceedings is before us because the present appeals are simply appeals from orders refusing to vacate the preliminary injunctional order. Upon appeal from a judgment intermediate orders involving the merits and necessarily affecting the judgment may be reviewed. (R. S. Sec. 3070.) But we know of no provision which authorizes a review of one order upon an appeal from another. (Breed vs. Ketchum, 51 Wis., 164.) That the court had jurisdiction to refuse to allow the plaintiff to arbitrarily discontinue the case and also jurisdiction to allow plaintiff to be substituted in his place was decided by this court in this very case. (State ex-rel vs. Ludwig, 106 Wis.)

FRANCHISES WOULD BE ANNULLED

"So the case reached this court upon the appeal from the order of June 9 in the same condition as it was in the trial court. The substitution of the Linden Land Company as plaintiff in place of the original plaintiff and the addition of Charles J. Eigel as a plaintiff, are accomplished facts not open to question or review, and we are to consider and decide whether under the pleadings and affidavits before the court they or either of them were entitled to the injunctional order originally granted. The case presented then is one in which two citizens claiming to represent many thousand similarly situated have come into court and challenged the validity of franchises granted by the City Council and demanded judgment that the grantee of the franchises be forbidden to accept or utilize them, a judgment which, if granted, practically vacates and annuls the franchises as effectually as if they were vacated at the suit of the State.

MUST SHOW INDIVIDUAL DAMAGE

"It is familiar law that courts do not revise, control or vacate the acts of a municipal government at the suit of private persons except as incidental or subsidiary to the protection of some private right or prevention of some private wrong. (Pedrick vs. Ripon, 73 Wis., 622 Nast vs. Eden, 89 Wis., 610.) The private person so suing must show something more than a mere speculative or theoretical wrong or illegal act; he must show an actual or threatened invasion or destruction of a distinct right belonging to himself or to the body of citizens for whom he sues. He cannot sue to prevent an act merely because it is illegal. Any other rule would render the transaction of municipal business well nigh impossible.

"The present action must be tested by this right. The claim of the plaintiffs is practically that they do come within the rule because they allege that they are taxpayers of the city and also abutting owners upon streets covered by the franchise, and it is very evident that if the action is sustained at all it must be on the ground that their rights, either as taxpayers or as abutting owners, or both, are threatened with illegal invasion.

"The claim that this is a proper taxpayers' action will first be considered. No court has been more liberal in maintaining the right of a taxpayer to vindicate the rights of himself and his fellow taxpayers against the actual or threatened malfeasance or nonfeasance of public officers than this court.

"The cases are numerous and many of them recent. Such actions may be brought where municipal authorities are about to unlawfully dispose of public property or pay out public funds or about to enter into unlawful and unauthorized contracts which will require public funds to discharge them, thus increasing the burdens of taxpayers or squandering the property of the taxpayers, or both. (Webster vs. Douglas County, 102, Wis. 181, and cases cited; Rice vs. Milwaukee 100, Wis. 516.) And in a proper case the court will go further and compel the unfaithful officers and even third persons to repay into the treasury sums already illegally paid out. These cases go on the principle that the money or property so squandered or about to be squandered is the money of the taxpayers, and hence every taxpayer has a substantial interest in it which he is entitled to have protected.

RIGHT OF TAXPAYERS

"Upon similar principles a taxpayer's right to enforce a case of action of the corporation is upheld when the corporate officials wrongfully refuse or neglect to perform the duty. (Estate of Cole, 102 Wis. 1.) Here the basis of the right is not that there is necessarily a personal and direct pecuniary loss to the taxpayer, but that the public moneys, rights or property are about to be squandered or surrendered, and that such moneys, rights or property belong to the body of taxpayers and are simply held in trust by the unfaithful public officers.

"This is well illustrated in the case of estate of Cole just cited, where real and personal property was willed in remainder to a city in trust for the establishment of a public library and a home for the aged poor, and a controversy arose between the executors and the city in the County Court as to whether certain expenditures upon the property should be charged against the life tenant of the property or against the corpus of the estate. The County Court decided against the city, and the city officials declining to appeal, a taxpayer interested took the appeal to the Circuit Court, and his right to do so was sustained by this court.

"Here no taxpayer could be said, in strictness, to have suffered a direct or pecuniary injury by the decision of the County Court or the failure to appeal therefrom, but the illegal diminution of the trust property was a distinct invasion of the property of the corporation in which each individual taxpayer or member of the corporation had a substantial interest, notwithstanding the property could only be used for the purposes of the trust, and its entire loss would not necessarily result in increased taxation. So understood, the case is in entire harmony with the general principles laid down in the other cases in this court.

THE 4-CENT FRANCHISE NOT A SQUANDERING OF FUNDS

"Further than this it is not believed that any case has gone in this court, nor is it believed that any further extension of the rule is expedient or necessary. So the question is whether it is shown in this case that any wrongful squandering or surrender of the moneys, property or property rights of the city or unlawful increase in the burdens of taxation is threatened by the proposed ordinance within the rule above stated. It is claimed that such a squandering of valuable property is shown because it is alleged that before the passage of the ordinance the city was offered $100,000 by a third party for the additional franchises granted to the defendant railway company by the ordinance, and also because it appears that the defendant company itself in the year 1898 offered to pay the city annually on the 1st of January of each year a large sum of money, beginning with $50,000, and increasing the sums each year by $10,000 until it reached $100,000 annually, on condition said city would grant the right to charge 5-cent fares until the year 1935. These offers were, however, rejected by the city, and the present ordinance adopted, by the terms of which no moneys are to be paid to the city, but the company is required to sell twenty-five tickets for $1, good for travel during certain morning and evening hours until Jan. 1, 1905, and after that time good during all hours of the day.

"It seems very plain to us that this action of the Council cannot be called in any proper or reasonable sense a squandering of public funds or property.

DISCRETIONARY WITH THE COUNCIL

"The same considerations evidently apply to a number of other allegations in the complaint to the effect that the grant of the franchise will necessitate putting the city to great expense in repairing, widening and improving streets, and violates and will seriously injure the water system of the city by electrolysis of the pipes, thus increasing the burdens of the taxpayers. The fact that such injurious effects to streets or water pipes in the streets are liable to result from the granting of the franchise does not impair the power to grant it, but simply becomes an important consideration to be taken into account in the fixing of the terms which shall accompany the grant. This question also becomes a question of discretion.

CITY TO DECIDE ON BENEFITS

"By section 1862 R. S. the city is empowered to grant the use of streets and bridges to street railway corporations upon such terms as the proper authorities shall determine. Here is a broad grant of discretionary power. The question before the Council was, what terms shall be attached to the grant. Is it more beneficial to the public to secure a cash payment or payments which will benefit taxpayers only or to secure lower rates of fare for the public generally, or to impose other conditions. After exercising this discretion and deciding that the terms imposed should be a gradual reduction of fare rather than payment of money into the treasury, it cannot be said that any city fund has been squandered, lost or misused. Whether the city should receive any fund was a question for the Council in its discretion to decide. When it decided that there should be no fund, but that reduced fares or other

limitations upon the grant were more desirable for the public, it may or may not have exercised good discretion, but it has dissipated no city fund or property.

THAT OFFER OF $100,000

"And so with regard to the proposal of the third person to pay $100,000 for the additional privileges granted to the defendant company. The additional privileges were a few fragments of widely separated streets. If used by the defendant company in connection with its other lines covering almost the entire city with the system of transfers provided by the ordinance, they would probably complete a harmonious system, but if attempted to be used by an independent company as a separate line, it seems probable that they would be far less useful to the public. It was undoubtedly a question addressed to the sound discretion of the Council whether the franchise should be sold to a third person who could only run fragmentary lines or should be granted to a company which would be required to incorporate the fragments into its system, and thus furnish to the traveling public continuous trips under a transfer system from one part of the city to another for a single fare.

NO CAUSE OF ACTION STATED

"Such discretion is vested in the Common Council, and cannot be controlled by a taxpayer or any body of taxpayers. We have found no other allegations which can reasonably be claimed to state any substantial injuries to the plaintiffs as taxpayers within the rules governing taxpayers' actions, and the conclusion necessarily follows that no cause of action is stated in the complaint in favor of the plaintiffs as taxpayers only.

"But the question remains whether a cause of action is stated in favor of either plaintiff as an abutting owner of real estate. Before proceeding to consider this question upon its merits, it seems necessary to dispose of a preliminary question which was much argued, namely, whether one abutting owner can maintain such an action on behalf of all other abutting owners. It is very evident that in a proper taxpayer's action challenging the illegal waste or squandering of corporate funds or property, the question is one of common or general interest of many persons, thus bringing the case within section 2604 R. S., and allowing one to sue for the benefit of all, because the fund or property threatened is undivided, and the interests of the taxpayers therein are inseparable. But it is equally evident that the same considerations in no way apply to the interests of abutting owners who own separate parcels of property. In this case the interest of each property owner is separate and distinct from that of every other property owner.

INTEREST OF OWNERS NOT THE SAME

"One owner in severalty is in no way interested in the injury (if any) to his neighbor's lot. In fact, the owner of one lot may consider his property injured, and the owner of an adjoining lot may consider his lot benefited by the proposed street railway, and such may be, in fact, the case, resulting from the different uses in which the two lots are or may be put.

"It is true that it has been held by this court that in case of a threatened nuisance, affecting several parcels of real estate alike, the several owners may join in an action to prevent the projected nuisance. This principle has been applied to the construction of a bridge without legal authority which would be a nuisance to several riparian owners (Barns vs. Racine, 4 Wis., 454); to the unlawful encumbering of a park or public place with buildings which would constitute a nuisance to the owners of lots fronting upon it (Pettibone vs. Hamilton, 45 Wis., 402); also to the diversion of water in a river to the injury of several riparian owners (Grand Rapids W. P. Co. vs. Bensley, 75 Wis., 399). But the effect of these decisions is not that one may sue for the benefit of all, but simply that all such parties similarly affected are properly, though not necessarily, parties to an action. (Kaukauna vs. G. B. & M. Co., 75 Wis., 390.) They may join in one action if they choose, but they are not compelled to, and it follows logically from this that if they do not join, no one owner is bound by the result of another's separate action.

OWNERS MUST BE SIMILARLY SITUATED

"The theory of the action where one property owner sues for all is that the result is conclusive on all who are similarly situated, and whom the plaintiff rightfully represents, and such must be the theory, or else the plaintiff does not represent all, and the statement that he does is not only false, but absurd. It is palpably evident that the principle cannot apply to abutters because, as said before, they may join or not as they choose; if one can rightfully refuse to join, his rights manifestly cannot be litigated or determined in the action, and hence he cannot be bound by the result, and by no legal action can it be said that he has been represented in the action.

"It is well settled that the property owners in severalty cannot join as plaintiffs to set aside an illegal tax upon their separate lots, nor can they sue on behalf of themselves and other taxpayers. (Barnes vs. Beloit, 19 Wis. 93; Pier vs. Fond du Lac, 53 Wis., 421.) The line which divides this last named class of cases from the classes of cases holding that two or more property owners may join to prevent a nuisance affecting their several lots alike, is perhaps somewhat difficult to draw, but in any event neither rule justifies the bringing of the present action by one abutter for the benefit of all.

"Treating a street railway about to be laid upon a street without authority of law as a continued nuisance to the owners of abutting lots, the most that can be said under the decisions in this State is that two or more owners in severalty of abutting lots similarly affected, may join as plaintiffs, but that one cannot sue for the benefit of all, and a statement that he does so sue is mere surplusage.

AN IMPORTANT CONTINGENCY

"Whether, as in the present case, an abutting owner upon one street may join with an abutting owner upon another street a mile or more distant, even though it is intended to connect the lines upon the two streets with lines already existing, may be a serious question, but it is one which we do not feel called upon to decide. We are not now considering the case upon demurrer for improper joinder, and it seems that if it appears by the complaint and the papers used upon the motion to vacate, that either plaintiff was legally entitled to have the injunctional order maintained pending the action, then the motion to vacate was properly denied.

SUCH RELIEF NOT NECESSARY

"Proceeding then to consider the rights of the plaintiffs as abutting owners simply, and conceding that the pleading affidavits show the supposed franchise to be invalid, and hence that they were entitled to an injunction preventing the laying of the railway upon the particular street in front of the several lots, it is still impossible to see how they could properly demand that the railway company should be prevented from accepting the franchise, and thus, in effect, annulling the entire grant.

"Such relief was in no way necessary to the protection of any right they have as abutters; their lots and all rights therein were completely and fully protected from injury when the proposed railway was debarred from entering upon the street upon which their property abuts. They need nothing further.

RULE AS TO INJUNCTIONS

"The only true object and purpose of a preliminary injunctional order, either at common law or under the statute, is to prevent the commission or continuance of some act, 'the commission or continuance of which, during the litigation, would produce injury to the plaintiff.' (R. S. Sec. 2774.)

"The court may enjoin any threatened act during the litigation when such act would produce injury to the plaintiff's rights, but it will go no further than necessary for that purpose. The extent of the necessity marks the extent of the right to enjoin.

CANNOT BE DEFENDED FOR A MOMENT

"To go further, and enjoin other acts which if done do not affect the rights in litigation in any way, is simply an exercise of arbitrary power which cannot be defended for a moment. So it seems to us certain that so far as the preliminary injunctional order prevented the defendant railway company from accepting the franchise it should have been vacated because the acceptance could in no way affect the rights of either plaintiff. Upon the same principle it results that the Linden Land Company, suing to protect its rights as an abutter on Locust Street, had no standing in court to insist that the injunctional order restraining the laying of tracks on First Avenue, a mile and a half distant, should stand *pendente lite*.

"The building of a track on First Avenue could not injure its property nor affect its rights as to the building of a track on Locust Street a particle.

THE QUESTION AT ISSUE

"Thus the case is reduced to the simple question whether the plaintiff Eigel, as an abutting property owner on First Avenue, is shown to be entitled to an injunction, *pendente lite*, preventing the building of the track and operating of street cars in front of his property on First Avenue. That an abutting lot owner may enjoin the laying of a railway track which is about to be laid without authority of law on the street in front of his premises cannot be doubted for a moment. It is unnecessary to cite cases upon this proposition. In the present case it is claimed that the grant to the railway company is void, and conveys no power to lay tracks for several reasons which will not be considered.

JUST LIKE THE LA CROSSE CASE

"1. It is said that the laying and operation of an electric railway to be operated by the overhead system with trolley wires and supporting poles is an additional burden on the fee, and hence that it cannot be done without making compensation to the adjoining lot owners.

"This contention is ruled in the negative by the case of La Crosse City Railway Company against Higbee, 'present term,' where the exact question was discussed and decided. The ordinance in the present case is essentially identical with the one involved in that case; it authorizes the carriage of passengers only and in the absence of a showing that it is proposed to locate poles or structures in such manner as to interfere with a property owner's right of access to his property, it must be held that the present case is ruled by the La Crosse case upon this question.

AS TO COMMERCIAL RAILWAYS

"2. It is claimed that section 1862 R. S., under which the defendant corporation is incorporated, is unconstitutional because it attempts to authorize the formation of street railway operations vested with the power to carry freight as well as passengers, thus making it a commercial railway, and also authorizes municipal corporations to grant the use of streets to such railway companies for the carriage of freight and passengers, and nowhere provides for the payment of compensation to the abutting owners.

"It may be admitted for the purpose of the case that a railway authorized to carry freight as well as passengers becomes a commercial railway instead of a street railway, and that such a railway, when laid in a street, becomes an additional burden on the fee, and cannot be laid without the consent of, or compensation made to, the adjoining owners. (Chicago & Northwestern Railway Company vs. M. R. & K. Railway Company, 95 Wis. 561.) But this hardly meets the question. It is true that our statutes contain no provisions authorizing such companies to condemn private property in the streets of cities or villages, although such condemnation may be had outside of cities and villages, R. S. Sec. 1863a.

"It is not quite clear how this deficiency in the law affects the corporate character of the defendant corporation. It may render it impossible for it to lay or operate a track for the transportation of freight without actually purchasing the right from private owners to cross their lands, but the Legislature certainly had power to authorize the formation of just such corporations, and if it neglected to provide the corporation, when formed, with a means essential to its successful operation, the result would seem to be a very unfortunate one for the corporation, and perhaps one fatal to its business success, but not fatal to its corporate character. If such a corporation attempt to condemn, it could be successfully defeated by the fact that it was given no such power, and if it attempted to lay tracks without condemning, it would be stopped with the proposition that it was taking private property without compensation.

OTHER IMPORTANT CONSIDERATIONS

"Passing this question, however, there are other considerations which seem to us to answer the contention without serious difficulty. The law should be sustained, if possible, on any reasonable theory. Every intendment is in its favor. We think it may reasonably be said that this law was only intended to authorize corporations to use streets with the consent of the city for carriage of freight as against the rights of the public only, and not as against private owners, leaving such private owners in full possession of their rights to stop the construction, insist on compensation or give their consent, as they chose. Such was substantially the construction placed upon the act authorizing telegraph companies to place their poles in streets in the case of Krueger vs. Wisconsin Telephone Company, 106 Wis. This construction seems to us to be entirely reasonable; it deprives the property owner of no substantial right, and has the additional merit that it does not violently disturb the many valuable rights and property interests, both public and private, which, doubtless, have arisen, founded in good faith upon the validity of the legislation attacked.

RIGHT TO USE THE STREET

"Furthermore, it will be noticed that the corporation does not obtain its right to use any given street from the terms of its charter. It might exist for a century, and if no municipality saw fit to grant it a franchise to use its streets, it could do no business. In the present case, the city has not chosen to grant it any right to carry freight upon a single street; all the franchises which it owns by purchase, as well as the franchise now in question, simply confer the right to carry passengers only, or, in other words, to build and maintain a street railway in the usual and ordinary sense of the term, and we do not see how it can for a moment claim power to carry freight over its lines in the city of Milwaukee or do anything more than maintain a street railway, the carriage of passengers only. If it can only maintain and operate a street railway, it is quite difficult to see how the plaintiff can be injured in any way by the failure of the Legislature to endow the corporation with power to condemn private property.

IMPORTANT POINT SETTLED

"3. Another claim is that the ordinance is unconstitutional because it is in effect a special or private law 'granting corporate powers or privilege,' and so prohibited by section 31 of article 4 of the constitution. The argument is that the ordinance attempts to confer corporate powers and privileges: that it is a special act of legislation, that in enacting it, the City Council was simply exercising legislative power attempted to be delegated to it by the State, or in other words, was pro hac vice the Legislature; that under the constitutional provisions above cited, the Legislature itself could pass no such laws, and that the City Council can possess no greater power than the Legislature.

"This is an important contention, and, if it is well founded, is fraught with serious results to many interests, for it cannot be doubted that the power supposed to be granted to municipal corporations to grant such privileges as are herein questioned has been very frequently used.

"But there is a radical difficulty with the first premise, which demolishes the entire argument. While such franchises as were here granted are legislative grants, they are not corporate powers or privileges within the meaning of the constitution. When granted to a corporation, they become the property of the corporation, and so may be called franchises of the corporation, but they are not 'franchises essential to corporate existence, and granted as part of the organic act of incorporation.' State ex-rel vs. Portage City Water Company (present term).

"Some confusion undoubtedly exists in the cases on this subject, and such franchises have been sometimes called 'corporate franchises,' as noted in the case last cited, but this does not affect the true character of the franchises. The distinction was pointed out by Chief Justice Ryan in the railway cases, 35 Wis. 425, on page 560. Speaking of this very clause of the constitution, he said that the phrase 'to grant corporate charters,' and further 'a franchise is not essentially corporate, and it is not the grant of a franchise which is prohibited, but of a corporate franchise; that is, as we understand it, franchise by act of incorporation.' This construction was followed and approved in B. R. I. Company vs. Holway, 87 Wis. 584, and, indeed, it seems, upon reflection, the only reasonable construction which can be placed on the constitutional provisions. Such franchises as those before us may be sold and assigned, if assignable, or the corporation may be deprived of them by forefeiture, and yet the corporate existence would be in no way affected. This consideration effectually disposes of the argument on this point, and renders it unnecessary to inquire whether there may not be other infirmities in the argument which are equally fatal to it.

ANOTHER CLAIM OVERRULED

"4. Another claim made is that the Council had no power to extend existing unexpired franchises long before their expiration, and that even if it had such power the ordinance is void because it is unreasonable. It may be noted in passing that neither of the plaintiffs owns any property abutting on any of the streets containing existing lines of railway, and hence, as abutter, they would seem to have no interest authorizing them to attack these parts of the ordinance extending to the life of previous grants; but granting that they are entitled to raise that question, we do not think the ordinance can be held void on either ground.

POWER OF CITIES

"The statutes (Sec. 1862, R. S.) gives the municipality power to grant to street railway companies the use of streets without limitation, save that such grant be made 'upon such terms as the proper authorities shall determine.' This is certainly a very broad grant of power, certainly more comprehensive than the statute of Indiana, under which the case of City Railway Company vs. Citizens' Street Railway Company, 166 U. S. 557, was decided. In that case the law required that street railway companies should first 'obtain the consent of such Common Council to the location, survey and construction of any street railway through or across the public streets of any city, before the construction of the same,' and it was held that where a thirty-year franchise had been granted in 1864 to a street railway company for a term of thirty years, the unexpired franchise might legally be extended in 1880 (fourteen years before its expiration) for the term of seven years, so that it would not expire until 1901, and that the continued operation of the road was sufficient consideration for such extension.

"The case seems strictly applicable here. In the present case some of the existing franchises already owned by the defendant

railway company expired in the year 1924, and some in succeeding years, and they were all extended in terms until the year 1934. We are unable to see that there was lack of power to do this, nor that the extension of time was unreasonable. Many of the franchises were granted in very recent years, some of them as late as the year 1890, and franchises for terms of forty and fifty years, and even longer, are frequently upheld by the courts. We have been unable to find by an examination of the ordinance that its terms are unreasonable, at least to such an extent as would justify a court in declaring it void. To arrive at such a conclusion, the unreasonable character of the ordinance ought to be very clear.

"5. We pass now to a number of objections which may be considered together. They are, in effect, objections to the regularity of the Council proceedings in the adoption of the ordinance. It is said that section 940B of the Revised Statutes, which requires the application for the franchise containing the substance of the privileges asked for to be filed with the City Clerk, and published in the official paper for not less than two weeks previous to action on such publication, was not complied with; it is also said certain provisions of the city charter, requiring all ordinances to be referred to appropriate committees, and not to be acted upon except after report made by the committee, has not been complied with; it is also said that it appears that the officers of the railway company used corrupt methods in securing the passage of the ordinance, in that they agreed to pay large sums to certain citizens to induce them to cease their opposition to the passage of the ordinance.

"It is sufficient to say, with regard to these claims, that whatever may be the rule elsewhere, it has been held in this State that these questions cannot be raised at the suit of private parties. (Stedman et al. vs. Berlin, 97 Wis., 505.) That case was a taxpayer's action in equity brought to set aside the grant of a franchise to build and maintain public waterworks in the city of Berlin. The grantee of the franchise had accepted the franchise, and given bond for the performance of the requirements of the ordinance, but had not commenced to construct the plant.

"It was charged in the complaint that the franchise was void because the provisions of section 940B, R. S., had not been complied with, and that it had been procured by the grantee by means of improper and undue influence exercised by him upon the members of the Common Council. This court held, however, that the remedy to set aside a franchise irregularly or fraudulently granted under the circumstances there presented was by *quo warranto* or *scie facias*, at the suit of the State, and not in an equitable action at the suit of private parties.

COMPANY EXERCISING ITS PRIVILEGES

"The present case is substantially identical in its essential facts with the one just cited. It is true that no formal acceptance of the ordinance had been placed on file, but the company was shown to be in possession of its already constructed lines, and transacting its business thereon, selling tickets at the reduced rate, and performing the obligations required of it by the terms of its new franchises. It was certainly quite as much in the exercise of the privileges conferred by the franchise as was the grantee of the franchise in the Stedman case, who had not commenced even to build his plant. The principle here adopted is quite analogous to that applied to an application for leave to bring action in behalf of the State to annul the franchises of such a corporation on account of misuse or nonuse thereof. Such leave will not be given as a matter of course for every dereliction of duty, but it will be granted or not, as the interests of the public seem to demand. (Sate ex-rel vs. Janesvillle Water Company, 92 Wis. 496.)

"So here, upon the facts presented, it is not at all certain that the present franchise would be set aside at the suit of the State. It appears that a notice containing a full copy of the proposed ordinance was published for more than two weeks prior to the final passage of the ordinance. This is claimed to have been insufficient by the plaintiff, because he said it ought to have been published two weeks before any action was taken by the Common Council, and because the ordinance was amended in some minor details just before passage. Now it may be a serious question whether section 940B, R. S., means that the publication shall be made for two weeks before any action, however slight, or before final action. The section simply says: 'Before action.' It appears also that the ordinance, as originally presented, was referred to a select committee, who reported a substitute ordinance, and because it is claimed that the requirements of charter have been met, notwithstanding there were some minor amendments made, after the report and before passage. Furthermore, a resolution was passed by the Council at the same meeting, when the ordinance was passed granting time, the same franchise in identical terms with those contained in the ordinance, and, it is claimed, and with apparent reason, that if the ordinance fails, still the resolution may be effective.

"Section 1862 does not require the franchises to be granted by ordinance, hence it may undoubtedly be done by resolution. The resolution was first introduced on the night of its passage, hence the publication of notice was for two weeks previous to 'any action,' as well as to final action, and the charter provisions as to the reference of ordinances to committees does not apply to resolutions. Considering these facts, and the evident strenuous attempt to conform to all statutory requirements, it may be doubtful whether any court would feel that valuable franchises should be forfeited—even at the suit of the State, even though it might conclude that there was some irregularity in the proceedings. It is enough, however, that the question is not open in this action.

CHARGES OF CORRUPTION

"The same considerations in effect apply to the charge of corrupt practices. It is not charged that any member of the Council was corrupted, but that certain citizens who opposed the ordinance were bought off with money. This charge is explained in the answer as follows: The ordinance allowed the railway company to use a viaduct for the building of which a number of property owners had paid about $6,000 special assessments. As the building of the railway across the viaduct turned it partially into a railway bridge it diminished its usefulness to the property owners who had contributed to its erection. They objected to such use unless they were repaid what they had put into it over and above their share as general taxpayers. In this situation the officers of the street railway company agreed to make good to the property owners what they had paid by way of special assessments. This was done without concealment, but was known to all. Even were we disposed to find fault with the transaction, the rule of the Stedman case plainly covers it.

"We have discussed the case as presented upon the second motion to vacate; any separate discussion of the first motion is unnecessary. Our conclusion is that both motions should have been granted.

SUPREME COURT'S ORDER

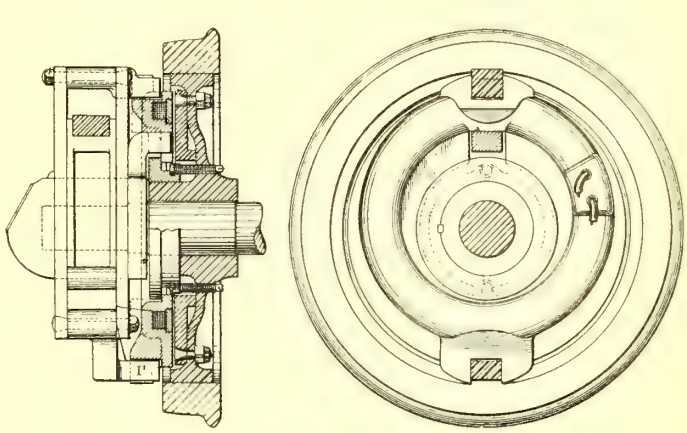
"By the Court.—Ordered reversed and action remanded with directions to vacate the preliminary injunctional order and for further proceedings according to the law."

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

ELECTRIC RAILWAY PATENTS ISSUED OCTOBER 23, 1900

660,315. Automatic Railway Switch; W. Schoenewald, Philadelphia, Pa. App. filed Oct. 17, 1899. Details of a switch adapted to be actuated by levers carried by the moving car.



PATENT NO. 660,487

660,353. Railway Crossing Structure; W. C. Wood, New York, N. Y. App. filed May 9, 1900. At the intersection of converging rails is a seat or floor, formed of iron, applied in a molten state to the rails, and serving as a binder. A wearing piece of special construction is removably attached to the seat or floor.

660,422. Car Truck; J. S. Francis, Bloomington, Ill. App. filed May 16, 1899. Details of an all-metal truck.

660,465. Track Cleaner; E. Sarver, Deadwood, South Dakota. App. filed Jan. 20, 1900. Comprises revolving cutters, adapted to remove the packed snow and ice from opposite sides of the rails of the track.

660,484. Rail-Joint; H. M. Boyd, Sierra Blanca, Texas, and H. Redmon, Cynthiana, Ky. App. filed Jan. 31, 1900. Provides a fastening means for rail-joints consisting of complementary parts

of similar formation, which are adapted to embrace the bottom and top sides of the foot and the sides of the web, and extend along the underside of the head.

660,487. Electric Brake; F. E. Case, Schenectady, N. Y. App. filed Aug. 5, 1898. The brake shoe is applied to the outside of the wheel, the wheel being provided with a properly machined surface. The shoe is adapted to follow the end play of the axle to avoid variations of the air gap.

660,546. Sander, B. B. Jenkins, Toronto, Canada. App. filed July 17, 1899. Consists of a hopper having a slide-valve at the bottom, which is operable from platform of car. The opening of the valve vibrates an agitator and loosens up the sand.

ELECTRIC RAILWAY PATENTS ISSUED OCT. 30, 1900.

660,565. Street Car Fender; H. Furstenau, Wandsbeck, Germany. App. filed March 3, 1899. Comprises a netting and a frame having rollers adapted to run on roadway ahead of the car.

660,610. Supporting Strap for Cars; L. T. Yoder, Pittsburgh, Pa. App. filed Nov. 27, 1899. Consists of a series of straps rigidly secured to the overhead rod and to each other at their crossing points, and having loops at their lower ends.

660,645. Track Brake for Railway Cars; E. L. Lowe, San Francisco, Cal. App. filed March 23, 1900. Consists of a brake block and shoe having their contacting surfaces inclined, the opposite side of the shoe being parallel with the railway track.

660,647. Brake-Operating Mechanism; J. E. Normand, Watertown, N. Y. App. filed July 29, 1899. The brake shoe has but a single point of support, a spring being arranged to hold the shoe initially in the correct position, but which, when the brake is applied, is flexible enough to permit the brake to assume its correct relation with the face of the wheel.

660,648. Brake-Operating Mechanism; J. E. Normand, Watertown, N. Y. App. filed July 29, 1899. Comprises brake beams with an equalizing lever connected thereto, and an operating lever for applying pressure to the equalizing lever, there being a universal joint between the equalizing lever and the operating lever.

660,649. Equalizing Lever; J. E. Normand, Watertown, N. Y. App. filed July 29, 1899. Comprises a system of equalizing levers adapted for use with a power brake, which may be also added to the rigging of a hand-brake system.

660,650. Air Brake; J. E. Normand, Watertown, N. Y. App. filed Sept. 21, 1899. Comprises an automatic valve mechanism; adapted under variations of pressure in the train-pipe, firstly, to permit free communication between said service reservoir and said reinforcing reservoir in either direction under normal or running conditions; secondly, to close communication to or from said reinforcing reservoir and to open communication between said service reservoir and said brake cylinder, under ordinary conditions; and thirdly, to open communication between both said reservoirs and said brake cylinder under full service stop conditions.

660,673. Railway Switch Operating Mechanism; W. Warneke, Milwaukee, Wis. App. filed July 2, 1900. Details of switch mechanism adapted to be tripped by a device lowered from the platform of the car.

660,779. Fender for Trolley Cars; L. Madas, New York, N. Y. App. filed Aug. 17, 1900. Structural details.

660,805. Actuating Device for Railway Appliances; E. A. Sperry, Cleveland, Ohio. App. filed May 17, 1897. A movable part lying in the path of a wheel or wheels of a locomotive or vehicle, and suitable connections between said movable part and the appliance to be actuated whereby the said appliance may be actuated in either of two directions or left quiescent by the torque condition of said wheel or wheels.

660,825. Actuating Device for Railway Appliances; E. A. Sperry, Cleveland, Ohio. App. filed Oct. 17, 1899. Relates to the automatic operation of switch points. (See preceding patent.)

660,903. Buffer for Street Cars; P. M. Kling, St. Louis, Mo. App. filed June 11, 1900. Details of a spring buffer.

660,904. Car Seat; P. M. Kling, St. Louis, Mo. App. filed June 11, 1900. Structural details of a reversible seat.

660,958. Car Wheel; I. Hogeland, Indianapolis, Ind. App. filed May 16, 1900. A car wheel comprising a center having a stepped periphery, two of the faces of which, at opposite sides of the central face, are radial, and a tire having a stepped interior corresponding with the stepped periphery of the center; all of said mating faces being grooved or corrugated and spaced to receive packings or cushions between them.

11,867 (reissue). Mechanism for Operating Fare Registers; J. F. Ohmer and H. Tyler, Dayton, Ohio. Provides means whereby a single operating device arranged to receive motion of only one kind or in only one plane determines by the amount of such motion the particular class of fare to be indicated and registered, while the second operating device serves to register the fare selected by the position to which the first operating device has been moved.

PERSONAL MENTION

MR. GEORGE H. WALBRIDGE, of the J. G. White Company, of New York, and Miss Mary G. Taylor were married on Oct. 17.

MR. JAMES ROSS, vice-president of the Montreal Street Railway Company, of Montreal, Que., has just returned to Montreal after a two months' trip to England.

MR. J. A. BENDURE, purchasing agent and superintendent of the Atchison Railway, Light & Power Company, has been engaged to superintend the reconstruction of the Colorado Springs Street Railway Company.

GENERAL BENJAMIN FLAGLER, of Niagara Falls, died Oct. 30. General Flagler's military connections are well known, and he was also a prominent business man in Western New York. He was president of the first street railway at Niagara Falls, first vice-president of the Niagara Falls Power Company, and president of the Bank of Suspension Bridge since its organization in 1886.

MR. GORDON CAMPBELL, who for seven years has been connected with the North Jersey Traction Company and its predecessor in the capacity of purchasing agent, has accepted a position with the Union Railroad Company, Providence, R. I. Mr. Campbell is to begin his duties at once, his office being that of general superintendent. For two years he occupied the position of master mechanic as well as purchasing agent in Jersey City, so that he has a thorough knowledge of all the departments of a street railway company, and will undoubtedly prove a most satisfactory addition to the personnel of the Providence company.

ENGINEERING SOCIETIES

ENGINEERS' CLUB OF COLUMBUS.—A regular meeting of this club will be held Nov. 17. W. H. Miller will present a paper entitled, "On Application of Brakes."

BROOKLYN ENGINEERS' CLUB.—At a regular meeting of this club, held Nov. 8, Macdonough Craven presented a paper entitled, "The Burning of City Wastes: When and Where Advisable."

AMERICAN SOCIETY OF CIVIL ENGINEERS.—A regular meeting of this society was held at the Society House, New York, Nov. 7. Two papers were presented for discussion: "Canals Between the Great Lakes and New York," by Joseph Mayer, and "Great Lakes to the Atlantic," by George Y. Wisner.

NEWS NOTES

PINE BLUFF, Ark.—G. F. Carter and R. M. Nuall, of New York, are here in the interest of a new electric railway project. It is said that they will make an effort to secure a franchise from the City Council at once. W. H. Keyser, of Chicago, now holds a franchise for a line here, but, as no work has as yet been done, it is believed that it will undoubtedly be forfeited.

NEW HAVEN, CONN.—A head-on collision occurred between two cars of the Fair Haven & Westville Railroad on Oct. 30. The motorman of one of the cars was severely injured, and the cars were badly damaged.

ATLANTA, GA.—An accident to one of the engines in the Atlanta Railway & Power Company's plant caused a temporary suspension of traffic on its lines from 6:55 p. m. to 10:30 p. m. on Oct. 25.

AURORA, ILL.—The Aurora, Yorkville & Morris Railroad has just been completed and placed in operation.

CHICAGO, ILL.—A car of the Chicago City Railway Company crashed into a south-bound Illinois Central suburban train, Nov. 2, severely injuring the motorman and three passengers.

CHICAGO, ILL.—A peculiar accident happened on the State Street cable line Oct. 26. A cable train consisting of a grip car, an ordinary trailer and an electric motor car run as a trailer, when going at full speed, struck an obstruction in the slot at a switch just south of Madison Street. The shock telescoped the grip car and first trailer. Seven persons were injured.

CHICAGO, ILL.—The Paige Iron Works' plant at this place was destroyed by fire Oct. 27. The company will rebuild the plant as soon as insurance matters can be adjusted, and its numerous contracts will be filled as promptly as possible consistent with the delay. The temporary offices of the concern will be at 33 Ontario Street, just across the street from their property, and at 11 Fifth Avenue.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week, in order to secure insertion in the current issue.

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Opening of a Large Interurban Road

The Ohio River Electric Railway & Power Company opened its new line in Southern Ohio on Wednesday, Nov. 14. This new road runs from Racine to Middleport, a distance of more than 12 miles, passing through the towns of Syracuse, Minersville and Pomeroy. It is expected that there will be a large freight business in addition to the regular passenger service, and electric locomotives are included in the equipment.

Chicago City Railway to Retire Bonds

It is announced that the Chicago City Railway Company will retire its bonds which expire July, 1901, by issuing new stock. There are $4,619,500 in bonds outstanding, and they bear interest at the rate of 4½ per cent. The new stock is to be offered at par to present stockholders. The company has issued $500,000 new stock this year, making the present total $13,500,000. There is still $500,000 of stock authorized, but not issued. A new issue of $5,000,000 will be authorized in all probability when the bonds are retired. This will bring the total capital stock up to $19,000,000.

No Changes in St. Louis

The St. Louis *Star* recently contained the surprising announcement that President Edward Whitaker, of the St. Louis Transit Company, and George W. Baumhoff, general manager of the company, were to resign. It was announced that Capt. Robert McCulloch, of Chicago, formerly of St. Louis, was to return to St. Louis as successor to Mr. Baumhoff, and that Murray Carleton, the present vice-president of the St. Louis Transit Company, was to succeed Mr. Whitaker. Our St. Louis correspondent, who was communicated with as soon as this news was received, telegraphs us that Mr. Whitaker emphatically denies that either he or Mr. Baumhoff have resigned or will resign.

Norfolk Houses Destroyed by Fire

The car house of the Norfolk Railway & Lighting Company was destroyed by fire, Nov. 11, together with fifty cars. The fire was discovered at 1 a. m., after the cars had all been turned in for the night. There were sixty-one cars in the house at the time the fire was discovered, but by heroic efforts eleven of these were saved. The loss is estimated at $150,000. The fire has crippled service in the city, and there will be no relief until cars can be obtained from other cities. The company has already begun the work of securing new cars, and expects to resume regular operations in a few days. The origin of the fire is unknown.

Lynn & Boston to Increase Its Capital

The Massachusetts Railroad Commissioners have just issued an order approving an issue of 10,160 shares of additional capital stock by the Lynn & Boston Railroad Company, of Lynn, in addition to its present outstanding capital of $2,271,000. The value of the shares, to be offered proportionately to stockholders, is $130 per share. The order is on the petition of the company that it may issue $1,500,000 additional capital. In approving the new issue of stock the board recommends that the company continue to limit its dividends to 6 per cent per annum, until the impairment of capital shall have been made good, and requires that the existing contract providing for the issue of coupon notes to the value of $310,000 shall be canceled. It orders that, of the increase granted, $124,000 shall be used to the refunding at par value of outstanding bonds issued Oct. 9, 1894, amounting to $161,200. The Board also orders that $607,000 shall be applied to the payment and funding at par value of outstanding coupon notes amounting at par value to $789,100; that $54,000 shall be applied to the necessary cost of the purchase of additional rolling stock; that $138,000 shall be applied to the necessary cost of improvements in the power station at Salem, and $29,000 to the necessary cost of improvements in the power station at Wakefield; that $21,000 shall be applied to the necessary cost of the Essex Falls transmission line, and $14,000 to the necessary cost of equipment for the sub-station at Essex Falls, and that $29,000 shall be applied to the necessary cost of the new building and equipment of sub-station at Gloucester, and any excess in the proceeds of said stock over and above the amounts required for the purposes aforesaid shall be applied to the payment for permanent improvements and additions to the street railway property.

Chattanooga Purchase and Improvements

The Rapid Transit Company, of Chattanooga, Tenn., has just purchased the property of the Chattanooga & Lookout Mountain Railroad, Lookout Point Incline Company and Lookout Incline & Lulu Lake Railway, and has announced that important improvements are to be made in its system. The properties purchased were mainly owned by J. T. Crass. The purchase price is not announced. The improvements to be made in the system include extensions, additions to power station, and the general reconstruction of the property just acquired. The lines of the Rapid Transit Company will be extended to the top of Lookout Mountain, a line will be around Lulu Lake on the mountain, and a loop will be built at East Lake, and cars run directly from the city to all points, including the top of the mountain. The Sherman Heights line will be extended to Boyce Station, and a loop will be built around East Lake. The power station equipment will be more than doubled, and, when all these improvements are completed, there will be a network of lines touching every suburban point.

Details of the Birmingham Consolidation

The details of the Birmingham, Ala., consolidation, which was concluded Oct. 17, 1900, and which has been previously noted in the Street Railway Journal, have been made public. The consolidated companies are the Birmingham Railway & Electric Company, Birmingham Traction Company and the Birmingham, Powderly & Bessemer Railway Company, and the official title of the consolidation is the Birmingham Railway, Light & Power Company. The capital stock of the company is $1,500,000, divided in 15,000 shares, of a par value of $100. It has been decided to issue bonds to the amount of $3,500,000. They will be fifty-year bonds, of the denomination of $1,000, and bear interest at the rate of 5 per cent. They are to be payable in gold, and to be a first lien on the property of the company now owned or hereafter acquired. Of the stock of the consolidated company, 10,000 shares are to be held in the treasury for further use; 5000 shares are to be delivered to the stockholders of the Birmingham Traction Company, and 500 bonds are to be delivered to the bondholders of said company; 100 bonds are to be delivered to the bondholders of the Birmingham, Powderly & Bessemer Railway Company and the outstanding bonds of the last named two companies are to be delivered to the consolidated company and canceled. The remaining bonds of the consolidated company are to be left in its treasury for the purpose of acquiring other property, or making further consolidations with other companies.

First Annual Meeting of the J. C., H. & P. Ry. Co.

The first annual meeting of the Jersey City, Hoboken & Paterson Railway Company, of Hoboken, N. J., was held Nov. 5. The company is a most important one in New Jersey, and is a consolidation, November, 1899, of practically all the electric railways in Northern New Jersey, which were not already under the control of the North Jersey Street Railway Company. This latter company is also controlled by the same interests. The Jersey City, Hoboken & Paterson Railway Company is a union of the North Hudson County Street Railway Company, Paterson Street Railway Company, Paterson Central Electric Railway Company, Saddle River Traction Company, Palisades Railroad Company, White Line Traction Company, Paterson, Passaic & Rutherford Electric Railway Company, Jersey City, Hoboken & Rutherford Electric Railway Company and Paterson Horse Railway Company.

The report of the company for the year, it is said, shows a surplus of $100,000. At the meeting of the company many new directors entered the directorate. The old directors who were re-elected are: David Young, John F. Shanley, William C. Shanley, A. P. Hexamer, Edward L. Young, Gen. B. W. Spencer. The new directors who have just been elected are: Dennis McLaughlin, E. F. C. Young, William B. Gourley, Randal Morgan, Gen. William C. Heppenheimer, Chandler W. Riker, Charles A. Sterling, John R. Lee, J. E. Hulshizer.

Municipal Ownership Discussed at Chicago

At a banquet of the Merchants' Club, of Chicago, held Nov. 10, municipal ownership of public utilities was discussed, and papers were presented by Professor Edmund J. James, of the University of Chicago, and Colonel E. R. Bliss. Both the speakers urged against municipal ownership. Professor James fears that municipalization will greatly increase what he terms the "functionary class"—those who would strive to obtain a position under the municipality, and then become inactive and remain dormant—and the large increase in political patronage.

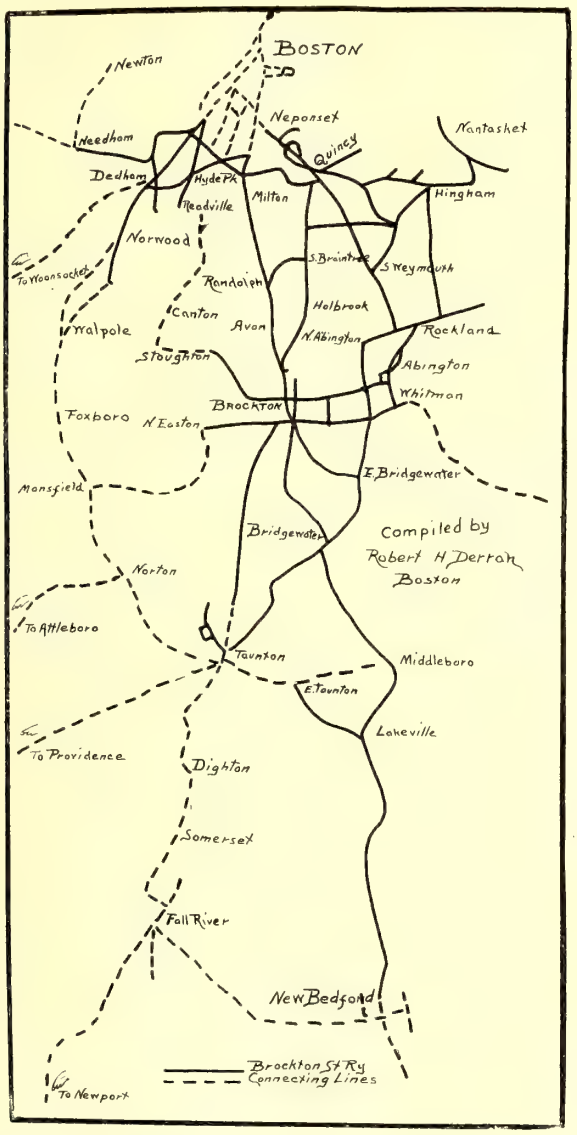
Professor James said, in part: "Private management is, on the whole, more efficient, and operates under favorable conditions at a lower cost of production, and leaves, therefore, possibly a larger margin of profit for the community. This, in spite of the fact that individual instances may be found of very capable public management; in spite of the fact that municipalities may be able to borrow money at lower rates of interest than private corporations; in spite of the alleged fact that public employees have a keener sense of loyalty to the community than private employees to the company; in spite of the fact that with every passing year the efficiency of the municipality as a business agent is increasing. Another reason in my mind for rejecting municipal ownership as a general and satisfactory solution at present is that such a solution would end in increasing enormously the functionary class in our society—the class which, instead of depending upon its own right arm and good cause for getting on in the world, depends on getting a place at the public crib, where, protected by the conservatism of public employment, it may lead a life, if not of ease, at least of inertia, lack of initiative, and lack of strenuous effort. This objection holds especially against a permanent civil service—the absolutely essential condition of reasonable efficiency in public, as in private, employment."

Colonel Bliss said, in part: "The policy of municipal ownership does not attempt to destroy monopoly, but to create perpetual monopoly. Its advocates propose that the city shall monopolize all these utilities, taking them out of the hands of private corporations in order to secure for the public the full measure of all possible benefits to be derived from them. They present this as a business proposition in no wise related to socialism. As proof of this they quote Lord Salisbury, who, when once accused of tending toward socialism, replied that it was simply a question of business, and that each age, and each people, and each country must decide for itself as to what work it would do as an owner and what work it would let out to private corporations. This statement assumes that the question is still an open one. It does not involve the taking over of large property interests already established and in successful operation under private management, or the assumption by the municipality of a large amount of indebtedness in the form of capital already invested in these public utilities. It is well known that at that time the conditions existing in Great Britain and in the countries of continental Europe were vastly different from the conditions now existing in the United States. Nowhere in Europe was there a system of urban transportation worthy of the name of street railway, and gas and water supplies were totally inadequate. Investors hesitated, and investments were correspondingly slow in the development of public utilities, and in many instances investors, appalled by the gigantic demands made by the rapid growth of many of the European cities, absolutely refused to assume the risk. It was, therefore, true that in its application there it was a question of business rather than of socialism. If Chicago to-day was without a complete system of street railways, without an ample supply of gas, and without an efficient telephone and electric lighting service, the question then at issue might be as Lord Salisbury stated it; but when the question arises regarding industries that have been developed by private corporations, are owned by them, are in successful operation under their management, and in the main meet all public requirements, in the logical sequence of events, Lord Salisbury's statement must be reversed. Under such conditions, each age and each people, and each country must decide for itself what work shall continue to be done by private enterprise and what work shall be let out to political corporations. Municipal ownership, under existing conditions in this country, does not mean the wiping out of monopoly; it means the destruction of private property, for the purpose of enabling a municipal corporation to enlarge its functions and render an industrial service previously rendered by a private corporation."

The Brockton Street Railway

Since the beginning of the year twenty-two street railway companies to the north and south of Boston, controlled by the Massachusetts Electric Companies, but operated independently, have been merged into two companies, viz.: The Lynn & Boston Railroad Company and the Brockton Street Railway Company. The Lynn & Boston, on the north side, has purchased the stock of ten

companies, viz: Reading & Lowell, Woburn & Reading, Wakefield & Stoneham, Mystic Valley, Salem & Wakefield, Gloucester, Essex & Beverly, Gloucester, Gloucester & Rockport, and the Rockport Street Railway. A full account of this consolidation was given in the STREET RAILWAY JOURNAL for March 24, 1900. The Brockton Street Railway Company, on the south side, has absorbed eleven independent lines, viz.: Needham & Boston, West Roxbury & Roslindale, Norfolk Central, Norfolk Suburban, Bos-



BROCKTON STREET RAILWAY AND CONNECTING LINES

ton, Milton & Brockton, Quincy & Boston, Brockton & Bridgewater, Brockton & East Bridgewater, Taunton & Brockton, and New Bedford, Middleboro & Brockton Street Railways.

At the beginning of the year the Brockton Street Railway Company operated only 47 miles of track, connecting Brockton with a few suburban towns within a radius of 6 miles from the center of Brockton, but it has gradually extended its lines in all directions by purchasing the system of the adjoining companies until to-day, as will be seen by the accompanying map, it connects with the Boston Elevated Railway Company at four different points, besides reaching about every point of any importance along the South Shore and the Old Colony districts. One line, starting from Milton Lower Mills and extending southward to New Bedford, is the longest street railway line under one management in this section of the country. The company now operates cars in Dedham, Needham, Norwood, Walpole, Hyde Park, Milton, Quincy, Weymouth, Hingham, Nantasket, Braintree, Randolph, Holbrook, Avon, Rockland, Abington, Whitman, Brockton, Stoughton, Easton, Bridgewater, West Bridgewater, East Bridgewater, Rayham, Taunton, Middleboro, Lakeville and New Bedford, and less than two years ago the lines were operated by seventeen different companies.. The most recent additions to this system have been the lines of the South Shore & Boston Street Railway and the West Roxbury & Roslindale Street Railway.

It is surprising to note the changes that have taken place in Eastern Massachusetts since the Massachusetts Electric Companies obtained a controlling interest in thirty-three companies. By consolidation these thirty-three companies have dwindled down to eight, one in Rhode Island, one in New Hampshire, and the other six in Massachusetts. The most recent consolidations have been the Taunton Street Railway with the Globe, Lowell & Suburban with the Lowell, Lawrence & Haverhill, South Shore & Boston and West Roxbury & Roslindale with the Brockton Street Railway Company.

The capital stock of the Brockton Street Railway Company, prior to the purchase of the West Roxbury & Roslindale and the South Shore & Boston, was $2,312,400. This has been increased since the consolidation to some $3,500,000, and the company has obtained authority from the Railroad Commissioners for the right to issue $400,000 additional stock for the purpose of paying the floating indebtedness of the company.

Horace B. Rogers has full charge of the entire Brockton system.

To Test a Massachusetts Street Railway Law

The city of Worcester, Mass., is determined to have the courts decide the respective rights and liabilities of the cities, towns and street railway companies under the law passed by the Legislature in 1898, which provides for the removal of snow, and has brought suit against the Worcester Consolidated Street Railway Company to enforce payment of bills amounting to some $12,400, being the expense incurred by the city during the past two years in removing snow from the tracks and streets.

Prior to 1898 the street railway companies paid into the State Treasury a franchise or corporate tax apportioned according to the market value of the company's stock, less the local taxes on real estate paid direct to the different cities and towns by the companies. This corporation or franchise tax was paid to the different cities and towns in which the holders of stock resided, and, in addition to this tax, the street railway companies were obliged to keep the streets in which their tracks were located in good repair, and to remove snow and ice therefrom. The removal of snow and ice from the tracks to the traveled way, by the companies has been a source of contention since the very first. On many occasions have the street railway employees and the employees of the cities and towns been in conflict in the streets over the removal of the snow. This state of affairs continued until 1897, when Governor Wolcott recommended the appointment of a committee by the Legislature to investigate the subject of the relations between street railway and municipal corporations. In its report to the next Legislature (1898) this committee recommended that the different municipalities should have full control of the public ways, and be held responsible for their condition. For various reasons it was agreed that no set rule could be established as to the compensation to be paid to the different cities and towns by the street railways for the removal of snow and ice from the streets in which they operated cars, and a bill was finally presented to the Legislature, which, it was thought, would end the controversy. This bill provided that the corporation or franchise tax should be apportioned according to the market value of a company's stock, and that the amounts so collected should be paid by the State Treasurer to the different cities and towns where street railways were operated in proportion to the length of single track, instead of paying it to cities and towns in which the stockholders resided, as heretofore, for in many cases the stock was held in cities and towns where no road existed. In addition to this, and the real estate taxes, it was provided that the companies should be obliged to pay into the treasuries of the different cities and towns in which they operated cars an "excise tax," based on the gross receipts. Companies whose gross income per miles of track were less than $4,000 were taxed 1 per cent on the gross receipts; those more than $4,000 and less than $7,000, 2 per cent; those more than $7,000 and less than $14,000, 2¼ per cent; those more than $14,000 and less than $21,000, 2½ per cent; those more than $21,000 and less than $28,000, 2¾ per cent; those reaching $28,000 or more, 3 per cent.

The taxes paid to the different cities and towns by the street railway companies, directly and indirectly, through the State Treasurer, were to be applied toward the construction, repair and maintenance of public ways, and the removal of snow therefrom, entirely relieving the street railways from the removal of snow, or of any responsibility in keeping any portion of the streets, road or bridges through or over which they operate cars, in repair, except as required in their location grants and where they were obliged to remove the surface of the street in repairing or renewing tracks.

The interpretation of the act by the City of Worcester and the Worcester Consolidated Street Railway Company differs materi-

ally, and the courts are sought as a last resort. President Dewey, of the company, has written the following letter to the City Solicitor in reply to the city's demand for payment on account of expense incurred in removing snow from the streets during the past two years:

Worcester, Mass., Oct. 20, 1900.

A. P. Rugg, Esq., City Solicitor, Worcester, Mass.:

Dear Sir—In regard to the bills of the City of Worcester against the Worcester Consolidated Street Railway Company, of which you have sent me a memorandum, I do not find, upon investigation, that there is any obligation on the part of the company with reference to the bills numbered 2413 and 2491 for work done on Pleasant Street and Southbridge Street. The bills numbered 2028, 2179, 2366, 2369, 2370 and 2417, amounting to about forty-four hundred and twenty dollars ($4,420), are for work and material used in the repair and maintenance of public ways, and this company is advised and believes that it is relieved from any liability for such bills by the provisions of chapter 578 of the acts of 1898, even if there was any legal obligation therefor previous to the passage of that law. That act passed by the Legislature in 1898 provides for an excise tax to be paid by the street railway company, and to be "applied toward the construction, repair and maintenance of the public ways, and the removal of snow therefrom," and the company does not think that the Legislature intended that it should contribute by the payment of this tax for the repairs and maintenance of the highways, and in addition thereto still continue to pay for such repairs and maintenance as it had previously done.

As you are well aware, the various questions that have arisen under the street railway law of 1898 have never been passed upon by the courts, and the respective rights and liabilities of the cities and towns and street railway companies under that law have not yet been determined. You are also aware that lawyers differ as to the interpretation of various provisions of that law, and the street railway company, having been advised that it is not liable for the bills presented by the city, must decline to pay the same, and it does not seem reasonable that it should be expected to do otherwise until the matter has been adjudicated by the courts.

In this connection I desire to call attention to the fact that during the two years that the street railway law of 1898 has been in force the city of Worcester has received about twenty-seven thousand dollars ($27,000) as an excise tax, provided for by that law, to be "applied toward the construction, repairs and maintenance of the public ways and the removal of snow therefrom." According to the bills rendered this company, the city has during the past two years expended about forty-four hundred dollars ($4,400) for repairs and maintenance of highways which it claims this company should pay by reason of certain conditions in its franchises; it also claims to have expended about eight thousand dollars ($8,000) in the removal of snow.

Assuming that this company had been required to pay the entire cost of removing snow from the streets where its tracks are laid, which was never required, nor, so far as I know, ever suggested before the law of 1898 was passed, and assuming that but for that law it would have paid the several bills mentioned, amounting to about forty-four hundred dollars ($4,400), the toal cost to this company for repairs and maintenance of highways and removal of snow would have been about thirteen thousand four hundred dollars ($13,400), whereas it has paid to the city of Worcester by virtue of said law of 1898, to be devoted to the same purposes, about twenty-seven thousand dollars ($27,000), or twice as much as it would otherwise have been called upon to pay.

On the other hand, assuming that the city has expended eight thousand dollars ($8,000) for the removal of snow, and fails to recover from the street railway company the sum of about forty-four hundred dollars ($4,400) which the company claims it is relieved from paying by reason of the provisions of the law of 1898, the city will still receive from the company the sum of twenty-seven thousand dollars ($27,000) or about thirteen thousand six hundred dollars ($13,600) more than it would have received if the law of 1898 had not been enacted.

In consequence of the street railway law of 1898 the city also receives each year the tax upon the capital stock of the company which previously belonged to the Commonwealth, and which amounts to about fourteen thousand dollars ($14,000) a year, so that the city treasury has been further enriched to that extent by reason of this law, which is claimed by some to be most unfair and unjust to the city and its interests.

As the city will receive for the past two years a profit of at least thirteen thousand five hundred dollars ($13,500) from the excise tax, and about twenty-eight thousand dollars ($28,000) from the corporation tax, or tax upon the capital stock of the company, making a total of about forty-one thousand five hundred dollars ($41,500), which it would not otherwise have received, it would certainly seem as though it had derived some material benefit from the law.

Yours truly, Francis H. Dewey,
President of Worcester Consolidated Street Railway Company.

An unsuccessful attempt was made last year to have the law repealed. The act provides that after three years from October, 1898, the cities and towns may petition the Railroad Commissioners for a revision, and that the Commissioners shall, after determining the average cost for the work done by the different cities and towns for construction, repairs and maintenance of the streets and public ways, and the average annual payments made by the different companies, determine the percentage of the gross receipts that shall be paid to the different cities and towns annually, the proportion to be fixed at a rate equal to the annual cost incurred by the different cities and towns during the preceding three years.

The city of Worcester will receive this year (1900) $16,657.09 in the way of an excise tax from the various street railway companies, with the exception of the Worcester & Webster Street Railway, which has not as yet filed a report. The amount to be paid by the several companies follows:

Worcester Consolidated Street Railway	$14,882,09
Worcester & Suburban Street Railway Company	1,688.18
Worcester & Clinton Street Railway Company	78.32
Worcester & Marlboro Street Railway Company	8.50
Total	$16,657.09

The Electric Conduit Railway—Its Development and Construction*

BY F. G. CUDWORTH

The history of the development of the electric conduit railway is but a repetition of the successes and failures that have marked the development of every branch of electrical science, and its present high state of efficiency stands as a monument to the untiring energy and perseverance of the electrical workers of the last quarter of the nineteenth century.

Commercially speaking, electrical traction dates back scarcely fifteen years. It was introduced into the United States in an experimental railway at the Chicago exposition in 1883, four years after it appeared at Berlin.

In the fall of 1884 there was opened to the public at Cleveland, Ohio, 1½ miles of underground slotted conduit road. This was probably the first attempt to operate, on a commercial scale, any form of street railway, by electric traction, in the United States. It was certainly the first attempt at slotted conduit construction in this country, and while this attempt may not be safely styled a complete success, it was by no means a failure, being operated for nearly two years. The service was not sufficiently satisfactory to warrant its continuance.

In the Cleveland construction the Bentley-Knight Company used a wooden conduit, placed midway between the rails, the conductor bars being supported in very much the same way as in our more recent construction. Their motor was hung from the car body midway between the two car axles, and was connected to the axles by wire cables. This was, perhaps, the weakest point of the Bentley-Knight construction. While they realized one of the essential features of the motor problem, they did not at that time grasp the importance of the other, viz., that of positive gearing.

Late in 1884 there was witnessed the erection of the first practical overhead copper trolley wire in the United States, by J. C. Henry at Kansas City; 1885, 1886 and 1887 saw rapid advancement made in both line and motor construction. Early in the latter year Sprague commenced the construction of overhead trolley lines at Richmond, Va.; St. Joseph, Mo., and Wilmington, Del. But it was not until 1888 that the commercial street railway was in practical operation in the United States. In this year several roads began to operate and to carry passengers on schedule time.

Among the most successful lines were the Sprague road, at Richmond, Va.; the Thomson-Houston system, at Washington, D. C., and a conduit road installed by Bentley & Knight at Allegheny City.

That the early workers upon the problem of electric traction realized that the only feasible method of operating cars electrically was by some means of underground propulsion is proved by the repeated attempt, both in this country and abroad, to construct a successful conduit system.

It was recognized from the outset that this system must be much more costly; nevertheless, the urgency was felt to warrant the outlay, and numerous and expensive attempts were made to construct a conduit suitable for the successful and economical operation of cars. There is little doubt that this problem would have been successfully solved at this time, had not Sprague early in 1888 demonstrated the entire practicability of the overhead trolley, and thus offered a much cheaper substitute.

During 1888 and 1889 Bentley & Knight were making for the West End Street Railway Company, of Boston, the most pretentious efforts to solve the underground problem ever undertaken. The West End Company at that time was the largest street railway in the world, not only in miles of track but in number of cars operated.

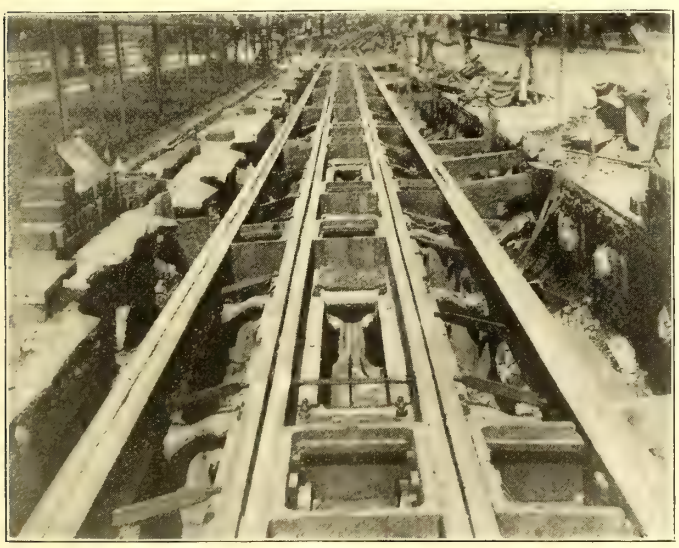
The signal failure of this experiment, after almost six months of attempted operation, during which time the system met with daily, almost hourly, breakdowns and delays, convinced the officials of the West End Company, and the public in general, that the underground conduit road could not be successfully operated, and led to the equipment of the entire West End system with the overhead trolley. This failure of the West End Company to con-

*Paper read at Brooklyn Engineers' Club, Oct. 11, 1900.

struct a successful conduit road practically stopped all further experiments along the line of underground construction, and gave a great impetus to the overhead trolley. The pronounced success of this latter system as a means of urban transit led to its rapid introduction into nearly every city in the United States, and the history of the development of the overhead trolley to its present high state of efficiency within the short space of ten years is without a parallel in the annals of the world's engineering.

It is safe to say that, had it not been for the stubborn and persistent refusal of the municipal authorities of New York City to consider any form of electric traction which contemplated the use of overhead wires, we should have had few experiments in the line of underground construction after the disastrous failure on the West End road. As it was, the officials of the Metropolitan Street Railway Company were compelled to seek for some system of traction equal, if not superior, to the overhead trolley. They turned their attention to the cable as the most desirable substitute. Plans were prepared, and in 1889 construction commenced. Yet on Jan. 1, 1893, the entire railway system of New York City, with the exception of a cable line on 125th Street and Amsterdam Avenue, was operated by horse-power, although the spring of this year saw the Broadway cable line from Fifty-Ninth Street to the Battery (10.2 miles) put in operation. Construction was continued, and in 1895 15 miles of additional cable lines on Columbus, Ninth and Lexington Avenues were opened. During this period of cable construction the company's engineers had not been idle. It was more and more evident that in spite of the improvements in the cable it would not do for a system as large as that now operating on Manhattan Island. Its gigantic power plants and street vaults, many of these containing sheave wheels a score of feet in diameter, could only be built and operated at a tremendous expense. It was recognized that the enormous cost of cable construction would alone limit its extension, and the directors of the Metropolitan Street Railway Company cast about for some other form of mechanical traction which would equal, and if possible be an improvement on, the overhead trolley.

The growth of electric traction abroad had not been characterized by that which had marked its development in America. Consequently the extension of the overhead trolley had been slow, and, owing to extended prejudice against overhead wire in general, engineers had spent considerable time in perfecting the underground system. At about the time of the Bentley-Knight

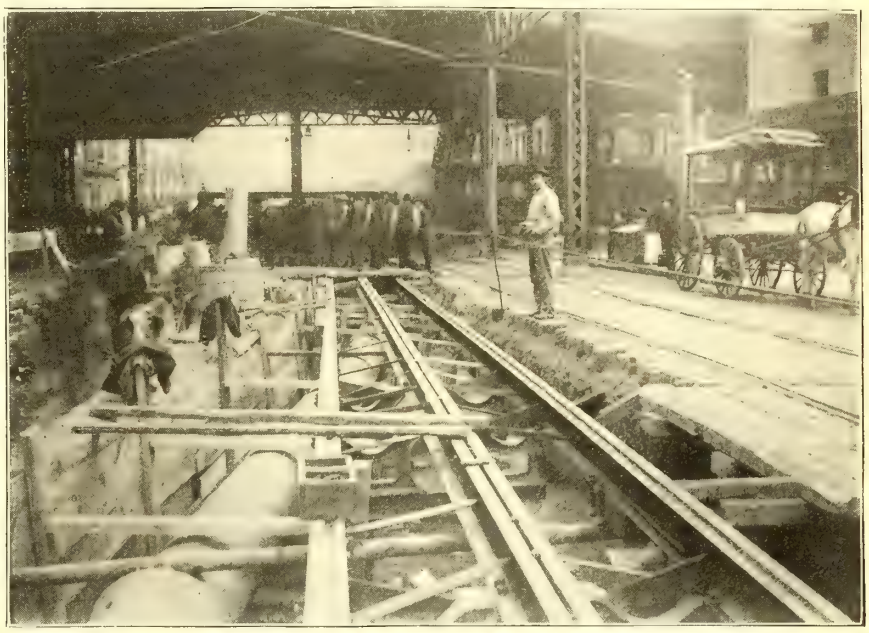


DOUBLE CONDUIT LINE ON THE BOULEVARD

failure on the West End system in Boston, a conduit road was constructed in Buda-Pest, Hungary, by the Siemens-Halske Company, and, as it was constructed in a very substantial manner, it is not strange that it proved a success from the start. The Buda-Pest road is built with the slot adjacent to the tram rail and not in the center of the track, as with the cable and conduit roads constructed in this country. In this case the slot serves not only for the plow but also as a groove for the wheel flange, consequently it is made much wider, and is, in the Buda-Pest system, 1⅛ ins. wide.

In this country many light road wagons have tires only ¾ in. wide, consequently the slot is limited to a maximum width of ¾ in., and cannot be used as a wheel groove, as the flange requires a greater width. Again, in the design of "special" work, where there is a complication of frogs, switches, turnouts, the center slot renders the design less complicated, and is to be preferred.

In 1892 William C. Whitney, one of the controlling spirits of



SOME OF THE OBSTRUCTIONS ENCOUNTERED.

the Metropolitan Street Railway Company, offered a reward of $50,000 for a system of mechanical traction suitable for the 190 miles of road then controlled by this company in New York City. It was proposed, in order to have the sanction of the State, and that the disposal of this princely reward might be entirely free from prejudice, to place in the hands of the State Board of Railroad Commissioners both the investigation of the plans submitted and the final award. The board decided, however, that it had no power to determine the matter, consequently the applicants began to forward their schemes to the railway officials, who were, in an exceedingly short time, completely swamped by the multitude received, nearly all of which were of an impracticable nature. It was clearly seen that if any advance was to be made the company must go into investigations on its own account. It was felt that the company could afford to spend a large sum in conducting experiments necessary to develop a system. The problem that confronted it was not only the development of an entirely new system, but with the reconstruction of some 200 miles of lines, so interwoven and united that one system must be adopted for the larger proportion.

That this was no easy problem was realized from the start; to install a system that would ultimately prove a failure and have to be abandoned, would mean the loss of the entire sum expended; consequently it was decided to send the company's engineer abroad, not only to investigate the Buda-Pest conduit system, but all kinds of mechanical traction there in use on the continent. After a detailed examination of the workings of the Buda-Pest conduit road, and a careful study of the drainage conditions, as compared with those of New York City, the engineer reported that he considered the underground electric conduit system which had been in operation in Buda-Pest for several years entirely superior to all others examined by him, and recommended its adoption, with modifications, by the company. He had examined, among other systems, hot water, compressed air, gas motor and storage battery. The Metropolitan Company proposed at this time to construct some 5 miles of cable road in the northern part of the city on Lenox Avenue. In accordance with the report of its engineer, however, the company decided to equip this line, experimentally, with the electric conduit system, conforming the construction as nearly as possible to its standard cable work, so that in case of the failure of the experiment the road could be changed to cable at a minimum expense. A contract was entered into with the General Electric Company, of New York, by which the electrical equipment was to be installed, and the road turned over to the railway company to operate for one year. If at the

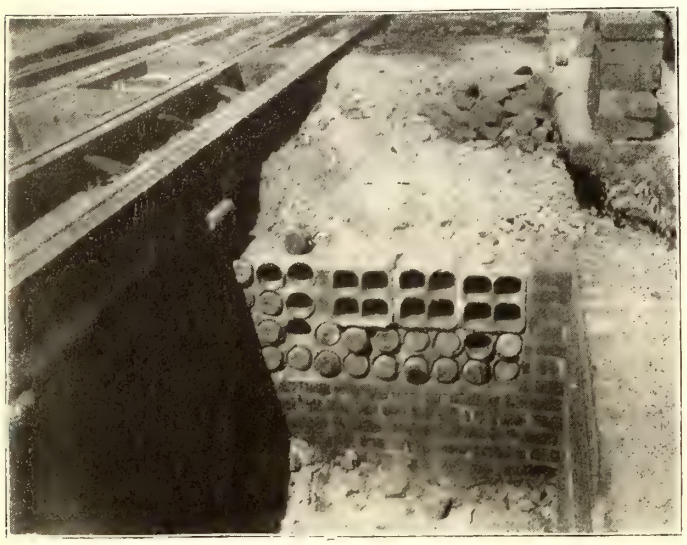
end of that time the road proved unsatisfactory, the electric company was to remove the equipment without cost to the railway.

Construction was commenced in September, 1894; the first car was operated April 1, 1895, and the Railroad Commissioners officially inspected the road during the same month.

This is, in brief, the history of the first attempt at operating an underground conduit street railway in New York City, and the success that marked the early operation of the Lenox Avenue road was most pronounced, and the difficulties attending its operation much less than those usually encountered in operating an overhead trolley road.

In the first two years of operation of the Lenox Avenue road there developed a few mechanical faults which had to be corrected, but there has been no serious interruption of the service, although the road has been in continuous operation twenty-four hours a day. Snow has given much less trouble than was expected, and it is the writer's opinion that the conduit system can be operated under all climatic conditions with no more difficulties than will be met with in running any form of mechanically operated road.

From this successful experiment the growth of the conduit system in New York City has been extremely rapid. It has been improved step by step. As weaknesses have developed under the strain of operation they have been removed and improved in the later construction, until the present standard, now in use by the



MANHOLE AND CONDUITS

Metropolitan Street Railway Company, for all slotted conduit work, is as near perfection as it is possible to carry a piece of mechanism.

The design has been criticized as being too heavy, and in the case of the Third Avenue system, which has lately completed its electrical equipment, it has been modified in a very marked degree. Radical changes have been introduced in the method of track construction, which time alone shall justify or condemn.

The tendency of the Metropolitan construction has been toward a firm, unyielding roadbed, while that adopted by the Third Avenue road has been the opposite. The latter company in its new construction returned to the old form of a longitudinal stringer beneath the "tram" rail, and, in the reconstruction of its old cable lines, the company placed a stiff spring beneath the rail-base to give elasticity to the road. This would appear to be a step backward, if we are to draw conclusions from the earlier experiments along the line of underground conduit developments, as the failure of these earlier experiments are all traceable to mechanical weaknesses.

It is a comparatively easy matter to construct a track for a steam or overhead trolley road, but when it becomes necessary to construct a longitudinal slot, the edge of which overhangs the supports, and to maintain this slot at a uniform width under all conditions of temperature and traffic, the problem becomes somewhat complicated.

Many of the common kinds of paving material, granite, wood, etc., expand to a considerable extent under different climatic conditions, and with a slot in the street the tendency is to expand in the direction of the slot. Consequently it is necessary to construct the slot sufficiently strong to withstand this expansion. This has been provided for in the more recent construction by using a comparatively heavy yoke. It will be seen that this expansion is a very serious matter, as the shank of the plow is 3/8 in. thick, and the slot itself is only 3/4 in., leaving a clearance of 3-16 in. between plow and slot rail. Besides this, the slot rail is subjected to a heavy strain from loaded trucks passing over it, consequently the rail and yoke must be proportioned to meet these excessive strains without being deflected or closed up, and the foundations necessary to support these yokes must be of a most substantial character.

The construction of special work where one or more lines cross is in itself a complicated piece of mechanism, but when that design must be made to withstand the strain of a loaded truck carrying from 40 tons to 60 tons, it presents a very difficult problem in mechanical engineering.

Taking up the main features of track construction, we will describe a section of standard track work, giving the method of construction as adopted in New York City. The yokes are placed 5 ft. apart, center to center, every third yoke being a so-called "box yoke." This is a cast-iron yoke, considerably heavier than the ordinary yoke, and arranged to receive the insulators for supporting the conductor bars. The foundations are, in all cases, of concrete, usually 6 ins. deep under the base of the yoke, and tamped in around it in the same manner that ballast is used in steam railroad work. Actual construction is carried forward in the following manner:

From a "base line," previously established on the sidewalk, the center of the track is staked out, and the excavation carried down to sub-grade. Forms are now placed in the excavations so that concrete can be laid for the foundation of the yokes. The concrete is deposited along the line of each track, usually some 6 ins. wider than the base of the yoke, and where the feeder ducts are laid at the same elevation as the bottom of the yokes it is made wide enough to receive them. The iron is now placed in the trench, the rails bolted to the yokes, and the track brought to the proper line and grade by means of wooden blocks and wedges. Concrete is now rammed around the base of the yokes and brought up between the yokes as far as the bottom of the conduit. The track is now ready for the sheet-iron lining. While the conduit itself is of concrete, it is made by placing sheet-iron forms between the yokes and ramming concrete against them; these forms are afterward removed, leaving a continuous tube of concrete. Earth back-filling is now brought up to within 15 ins. of the street surface, and the entire space between tracks, and for a distance of 2 ft. on the outside of the rails, is covered with a 6-in. layer of concrete. This forms the foundation for block paving, and in the case of asphalt, this concrete is brought up to within 3 ins. of the surface. Feeder ducts are usually laid along the outside of the rails in connection with the track work. There are no special numbers of these tubes, enough being put down to supply the present traffic, and to provide as far as possible for future growth. Manholes are built about every 400 ft. to allow connection being made with the feeder cables and conductor bars. These manholes are generally about 5 ft. wide and 4 ft. deep, and are long enough to permit of repairs being made to the cables, and for a new one to be drawn in without removing the street pavement, otherwise than to take off the cast-iron cover at the street surface.

The conduit itself is connected with cleaning manholes at intervals of from 95 ft. to 125 ft. These are for the purpose of draining the conduit, and to allow the removal of all accumulations of dirt, etc. They differ from the feeder manholes in that they extend from outside to outside of tram rails only, the entrance being between tracks. Each is connected to the nearest sewer with a 6-in. drain pipe; in fact, the best method is to connect all manholes, both feeder and cleaning, with the sewer, and provide each with a fair sized sump hole, from which a trapped drain leads to the sewer.

It was the practice, in the early conduit construction, to place these cleaning manholes 200 ft. or more apart, but it was found that the rapid accumulation of mud, which made it necessary to clean the conduit at least once a month in summer and oftener during the winter months, was so large that difficulty was experienced pushing the same to the manholes. This was especially the case with snow, which, finding its way into the conduit, became softened from the difference in temperature, and in a number of cases packed hard enough to break the plow before it was pushed to the manhole.

Different methods are used in cleaning the conduit, both horse and hand scrapers being used to drag the mud to the manholes, where it is removed and carted away. Recently an electric cleaning car has been developed, which is proving very successful.

In the electrical operation of the road the current is taken from the cable to a T-shaped conductor bar. These bars are in 30-ft. lengths, supported at each box yoke every 15-ft. by a heavy bottle-shaped insulator. The bars are placed in the conduit 6 ins. apart, face to face.

The contact is made by means of a plow. This consists of a

steel shank attached to the truck of the car, and extending down into the conduit. It carries at the lower end two steel springs, to which are fixed cast-iron shoes, shaped a good deal like a large spoon bowl. These shoes slide along the conductor bars and take the current from the bar to the shoe; from the shoes insulated copper wires lead to the motor. The path of the current is from the positive bar to the cast-iron shoe; thence along the insulated wire to the motor, through the motor to the wire on the opposite side of the plow to the negative shoe and negative conductor bar.

To facilitate the operation, the bars are divided into sections, usually 1 mile in length. These sections receive the current direct from the power station independent of all other sections on the road, and as both incoming and outgoing feeders are provided with independent switches at the power station, it is possible, in case of trouble on the line, to cut off any particular section without interfering with the cars on any other portion of the road. Another important fact in connection with this sectional arrangement of feeders, in the operation of a conduit road, which does not appear in overhead trolley operation, is that as both sides of the circuit are insulated from the ground, in the conduit system, leakage, when it does occur, must arise on one side or the other of the circuit, consequently this sectional arrangement of both conductor bars and feeders makes it possible to correct all trouble from grounds, and renders the interruption of traffic through the grounding of conductor bars impossible. With the positive and negative feeders connected with double-throw switches, it is a very easy matter to reverse the polarity of the conductor bars in any one section by simply throwing the feeder switches from one terminal to the other. For example: If a ground occurs on a positive bar in any one section, no trouble will arise unless another ground occurs on the negative side; in fact, several grounds might occur on the positive side without causing any trouble in operation. But let a positive and negative ground occur at the same time, even if a mile apart, there will doubtless be a serious loss of current, and probably an interruption in the service of the line. In such a case the engineer at the power station reverses the polarity of the bars on one of the grounded sections by throwing over the switches. The positive side is made negative, and the flow of current is immediately stopped, as both grounds are flung on to the same side of the circuit. In this way the only trouble that can seriously affect the operation of the underground system is guarded against.

The voltage adopted on the conduit lines is now the same as the standard for the overhead trolley—from 500 volts to 550 volts. The weight of rail used has been steadily increasing until at present it has exceeded that used by steam roads. Weights in 1898 were as follows:

Kinds of rail.	Length	Wt. pc.	Wt. ft. of Tr.	Wt. per. yd.
Tram	30 ft.	1070 lbs.	71 1-3 lbs.	107 lbs.
Slot	30 ft.	570 lbs.	38 lbs.	57 lbs.
Conductor bar	30 ft.	210 lbs.	14 lbs.	21 lbs.
Regular yoke		415 lbs.		
Box yoke		611 lbs.		

Trams, 9-in. girder; slot, 7-in Z-bar.

The standard for 1900 is a 60-ft. girder, weighing 109 lbs. per yard, while that adopted for the reconstruction of the Broadway cable is a 7-in. girder, weighing 107 lbs. per yard. This latter is connected by probably the heaviest and strongest fish-plate ever used in a surface road.

The Third Avenue road in its reconstruction work adopted a 60-ft. tram rail of the girder section. On the Third Avenue line, where the old cable conduit was utilized for the electric equipment, the old yoke limited the rail used to a 7-in. girder, having a 4-in. base. Accordingly a rail of that dimension of the standard New York section, weighing 104 lbs. per yard, and in 60-ft. lengths, has been used with the Falk cast-welded joint. The percentage of carbon in the new rail is 0.6 per cent.

The Metropolitan Company, during the present season, adopted the cast-weld joint for the first time, using it on the old rails of the Lexington Avenue cable line. This rail was a 7-in. girder badly out of line, and in some cases very much worn. The joint has stiffened the rail a considerable extent, and has made a marked difference in the ease of riding, but as to its prolonging the life of the old rail sufficiently to warrant the expense of the joint, is, in the writer's opinion, doubtful.

The cost of the cast joint is $4.25. This includes cleaning the rail with the sand blast, and furnishing all material necessary to properly weld the same. The cost of excavating and relaying pavement around joint was about $2.70, making the total cost of joint in the neighborhood of $7. This, at the present market price of steel rails ($26) is a little more than half the cost of replacing with a new rail.

Feeder ducts in use in New York City consist of three different designs. The McRoy, earthen tile in clusters of four each—3¾ ins., inside diameter, 6 ft. long. These were laid with three styles of joints. The first method was to use three pieces of burlap, two pieces being wrapped around the joint dry, the third being dipped in hot tar and placed around the other two. The second method used the same amount of burlap, cement being used in place of the tar on the last wrap. In the third method a dry wrap was used. In this the burlap is put on dry, being held in place by wires or narrow strips of sheet iron.

The National duct is of sheet iron, cement lined, 3¾ ins. diameter, in 6-ft. lengths. It has male and female joint, and is laid in cement mortar.

The Camp duct is an earthen tile, 18 ins. long, 3¼ ins. diameter, and is laid in cement mortar without special wrap.

As regards the cost of underground conduit construction, it is almost impossible to give an intelligent answer, owing entirely to the local conditions. This is especially true in New York City where account must be taken not only of numerous sub-surface obstructions, such as pipes, drains, sewers, etc., that must be taken up and relaid, but entire streets in a large number of cases have to be repaved. All this, combined with the extremely high price of special work, tends to bring the average cost per mile of single track to about $90,000, including feeders. Outside of New York City, where there are less stringent rules relating to the relaying of old pavement, and where there are less sub-surface obstructions, the underground electric conduit system can be installed for $35,000 to $50,000 per mile of single track.

The actual cost per mile of single track in the New York construction has been as high as $150,000, while special work at intersections has cost much higher; that at Twenty-Third Street and Sixth Avenue costing $59,650; Canal Street and West Broadway, $48,869; one double crossover and two double-track turnouts at Thirty-Fourth Street and East River, $95,333.97.

The Annual Meeting and Report of the Manhattan Railway Company

The annual meeting of the stockholders of the Manhattan Railway Company, of New York, was held Nov. 14. The old officers were re-elected as follows: George J. Gould, president; Alfred Skitt, vice-president; D. W. McWilliams, secretary and treasurer. No changes were made in the directorate, and the outgoing members of the executive and expense committees were returned.

The annual report of the operation of the company for the year ending Sept. 30 was presented at the meeting; it is appended, a comparison being made with last year's statement:

	1899	1900
Gross receipts	$9,325,111	$9,950,735
Operating expenses	5,286,182	5,195,312
Earnings from operation	$4,038,929	$4,755,422
Deductions from earnings:		
Interest on bonds	$1,889,680	$1,816,309
Taxes	827,608	872,335
Interest and taxes	2,717,289	2,688,644
Net income	$1,321,640	$2,066,778
Previous surplus	4,401,207	4,162,847
Total net income	$5,723,847	$6,229,626
*Dividends	1,560,000	1,920,000
Surplus	$4,162,847	$4,309,626

*Four per cent on $48,000,000 in 1900; 2 per cent on $30,000,000 and 2 per cent on $48,000,000 in 1899.

The number of passengers carried is given as 183,788,851 in 1900, as against 177,204,588 in 1899. This is an increase of 6,584,293, or an average of over 503,000 a day. The percentage of operating expenses to gross receipts, excluding all taxes, was 52.21 per cent for 1900, as against 56.69 per cent in 1899. The percentage of operating expenses to gross receipts, including all taxes, was 60.98 per cent in 1900, as against 65.56 per cent in 1899.

At the meeting of the company President Gould said: "The annual report to the stockholders shows the satisfactory growth and results of the company's business for the year ending Sept. 30. The electrical installation is making excellent progress. The heaviest work at the main power station at East Seventy-Fourth Street is completed, and the superstructure is being rapidly erected in anticipation of the first arrivals of machinery, due for delivery next month. The first electric train is completely equipped, and, through the courtesy of the officials of the Metropolitan Street

Railway in furnishing us with the necessary power, it will be put in operation on our Second Avenue line without delay. The company's general improvements and enlargement of facilities other than the change of motive power will begin to produce results in the very near future. The first stretch of the Fordham extension beyond Tremont will be ready for trains in a few days, giving entrance to the new yards on One Hundred and Eightieth Street, with a capacity for 325 cars. The new line from this point to Fordham will be finished early in January. Our plans contemplate the extension of express service from Eighty-Fourth Street to One Hundred and Twenty-Ninth Street, on the Third Avenue line, materially shortening the running time of express trains between Harlem and the lower part of the city. This improvement we expect to put into effect within the next thirty days. Generally, I may say that the outlook for the Manhattan system is most encouraging."

Annual Meeting of the Montreal Street Railway Company

The annual meeting of the Montreal Street Railway Company was held at Montreal, Que., Nov. 7. The annual statement of the company's affairs showed an increase in gross receipts of over $109,129 over 1899, and an increase in earnings from operation of $29,153. The number of passengers carried in 1900 was 43,362,262, an increase of 3,175,749 over 1899. Dividends, amounting to 10 per cent, have been paid during the year, totaling the sum of $512,500, and leaving a surplus of $134,746 over the year's operations. The operating expenses show an increase of 1.11 per cent, as compared with last year, due mainly to the more frequent and extended car service demanded by the city, and other increases, including that of wages of employees. The company's rolling stock has been increased during the year by the addition of fifty-six closed motor cars, forty-five open motor cars, seven supply cars, eighty trucks, and the electrical equipments for the cars have been increased by 128 motors and eighty-three controllers. There are at present six extra long closed motor cars, mounted on double trucks, under construction, making in all twenty-five cars of this new type. During the past year the company has paid taxes amounting to $168,679.

The operating report of the company for the year ending Sept. 30, 1900, is given herewith, and a comparison is made with the report for the year ending Sept. 30, 1899:

	1899	1900
Gross receipts	$1,660,776	$1,769,905
Operating expenses	912,949	992,925
Earnings from operation	$747,827	$776,980

The general balance sheets show:

ASSETS

Cost of road and equipment	$5,718,209
Real estate and buildings	1,557,785
Stores	48,256
Accounts receivable	43,397
Cash on hand	178,317
Cash on deposit with City of Montreal	25,000
Total	$7,570,964

LIABILITIES

Capital stock	$5,497,055
Bonds	973,333
Mortgages	6,035
Accounts and wages payable	69,588
Accrued fixed charges	90,231
Employees' securities	7,118
Unclaimed dividends	1,957
Unredeemed tickets	16,942
Suspense accounts	49,053
Dividend payable Nov. 2, 1900	135,000
Contingent account	164,333
Surplus	560,319
Total	$7,570,964

"In the Public Eye"

One of the Cleveland daily papers contains the following item about a well known street railway manager:

"Ira A. McCormick, general manager of the Big Consolidated, has done several things to bring him into the public eye of late. The first was when he broke all precedents by having signs placed across Euclid Avenue, telling people where to go to get cars for the East end, the avenue being minus cars on account of the Erie Street sewer. That a street railway company should take the trouble to tell the public anything was an innovation with a big I. A day or two later McCormick put placards in the cars instructing women how to get off the cars with least risk of falling. Innovation No. 2.

"Thursday, McCormick reached the pinnacle of fame by running open cars on Cedar Avenue during the snow storm. He got in the public eye for keeps by that stroke of genius.

"McCormick is a railroad man from the ground up, and that is saying a good deal, for he stands 6 ft. 3 ins. without his boots. He is built in proportion and commands attention wherever he is.

"The employees of the company like McCormick, and he's on friendly terms with all of them. He's a 'mixer,' and a prominent club man, but withal devoted to his family and home. He drives a fine pair of horses."

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

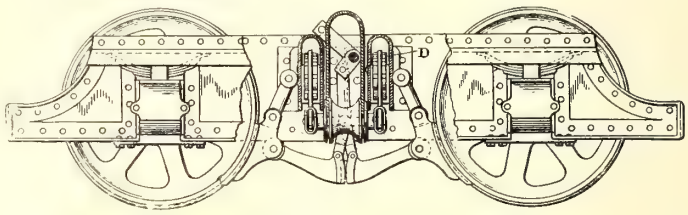
STREET RAILWAY PATENTS ISSUED NOV. 6, 1900

661,045. Mountain Locomotive; G. S. Fouts, San Francisco, Cal. App. filed Nov. 15, 1899. The construction is such that the pull or push of the load is exerted automatically to maintain the pressure of certain friction wheels, and to increase the pressure as the grade increases, whether in ascending or descending.

661,054. Railroad Switch; D. Isard, Camden, N. J. App. filed July 28, 1900. The switch point is held in either of its two positions by spring pressure.

661,077. Street Car Turntable; O. G. Rieske, Dayton, Ohio. App. filed July 22, 1899. The car standing on the turntable engages frictionally with wheels on the table, which are geared to a circular rack, when the power is turned on through the car, the car wheels drive the gearing of the table, and so rotate the latter.

661,123. Rail-Joint; W. W. Gillespie, Milwaukee, Wis. App. filed May 23, 1900. The invention relates to the construction of a sleeve, which is adapted to be placed around the rail-joint, and to be secured thereto by molten metal, which is poured into the sleeve and into contact with the rail ends.



PATENT NO. 661,432

661,305. Working Device for Railways with Automatic Correction of the Axles; J. De Buigne, Vienna, Austria. App. filed Dec. 30, 1897. The wheels are mounted loosely on the axle, and are movable independently of each other; each wheel has an outer flange instead of an inner flange, and means are provided for imparting rotary motion to each wheel independently of the other.

661,432. Car Truck and Brake; D. B. Van Dorn, Cleveland, Ohio. App. filed March 17, 1900. A car truck having its sides formed of single flat steel plates and edgings of angle-iron riveted upon the outside of said plates along their top and bottom and smooth plain inner surfaces.

661,442. Railway Car; J. A. Kratz, Baltimore, Md. App. filed March 22, 1900. By means of a system of levers one side step or running-board can be lifted while the other is lowered.

661,453. Railway Car Step; J. A. Kratz, Baltimore, Md. App. filed April 21, 1900. A modification of the preceding patent.

PERSONAL MENTION

MR. J. B. POTTER, the recently appointed superintendent for the Webster & Dudley Street Railway, of Webster, Mass., has just entered on his new duties.

MR. CLARENCE P. KING, president of the Pottsville Union Traction Company, of Pottsville, Pa., has removed his Philadelphia headquarters from 721 Walnut Street to the Real Estate Trust Building.

MR. C. S. M'MAHAN, Western representative of the Street Railway Journal, with headquarters at Chicago, has resigned that position, and with Mr. W. R. C. Smith, formerly of the *American Electrician*, have purchased the *Engineer*, of Cleveland, with which they will in the future be connected. Mr. McMahan and his associate have our best wishes in the new field in which they are engaged.

MR. W. E. HARRINGTON, general manager of the Camden & Suburban Railway Company, will sever his connection with the

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week, in order to secure insertion in the current issue.

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St. Louis Companies Liberal

The St. Louis Transit Company and the St. Louis & Suburban Railroad Company, the only street railway companies in the city, have just made the largest subscription yet received to the local World's Fair fund. The subscription is for $250,000, and makes the closing of the local fund of $5,000,000, a comparatively easy matter.

More Subways in Boston

The next Massachusetts Legislature will have before it two bills providing for a subway in Washington Street, Boston. Both bills will agree upon practically all points except that of ownership. The Boston Elevated Railway still adheres to its desire to own and control the new subway, which shall be built at its own expense. The other bill provides for construction and lease by the city.

The Boom in General Electric

We publish elsewhere in this issue extracts from a recent report of the General Electric Company, covering the seven months succeeding the period covered in the last annual report. The remarkable showing made in this report has been a great surprise to the majority of outside investors, and the stock of the company, scarcely any of which is obtainable, has mounted upward in giant strides.

Another Steam-Electric Conflict

The Maine Central Railroad is now making every effort to have the Railroad Commission decide adversely on the petition of the Lewiston, Winthrop & Augusta Electric Railway Company for permission to construct its proposed new road. It is simply another case of electric competition. The Maine Central, in opposing the grant, raises its familiar protest. The company claims that the State should protect the company's rights, and that the electric railway, if constructed, would virtually parallel the Maine Central tracks and prove a competitor fully as much as would a steam railroad.

Consolidation at Worcester

A special dispatch announces the consolidation of the Worcester Consolidated Street Railway, Worcester & Marlboro Street Railway, Leominster & Clinton Street Railway, and Worcester Suburban Street Railway. The consolidation was effected by the sale of the Worcester Traction Company's holdings of Consolidated Company stock. The Traction Company will go into liquidation. The consolidation will include seven companies with a total capital of $2,129,400. These companies last year carried 22,000,000 passengers, and earned $1,085,000 gross, and $111,663 net. The funded debt of the roads is $1,419,500, floating debt, $796,197. Oliver Ames, Samuel Carr and T. Jefferson Coolidge, Jr., of Boston, will be included among the directors of the new company.

To Build Electric Lines in Cuba

At a meeting of Canadian and American capitalists, held in Philadelphia, Nov. 8, the Cuba Development Company was organized with a capital of $20,000,000. It is announced that the purpose of the company is to secure control of electric light and railway franchises in Cuba, and to establish electric plants and railway systems in the principal cities. The enterprise owes its inception to Sir William C. Van Horne, of Montreal, and he, together with his son, R. B. Van Horne, of Montreal, has sailed for Santiago, Cuba, in the interest of the company. Among the most prominent Americans said to be interested in the company are: William L. Elkins, P. B. Widener, Thomas Dolan, George D. McCreary and J. J. Sullivan, of Philadelphia; R. A. C. Smith, president of the Cuba Mail Steamship Company, of New York, and Percival Farquhar, of New York.

Regular Meeting of the New England Street Railway Club

The next regular meeting of the New England Street Railway Club will be held at the Pathfinder Meeting Rooms, 67 Federal Street, Boston, on Wednesday evening, Nov. 28.

The previous meetings of the club have been chronicled in the STREET RAILWAY JOURNAL, and the papers read and discussions cannot help but be of great value to the street railway officials. The membership of the club now numbers eighty-five, although it has had but three meetings.

"Accidents" will be discussed at the next meeting of the club, and Charles S. Baxter, attorney for the Boston Elevated Railway Company, will open the discussion. Mr. Baxter is a graduate of the Harvard Law School, and has been connected with the legal department of the West End Street Railway and the Boston Elevated Railway since his graduation, or about twelve years.

"Trucks" will also be discussed, but no assignment has been made on this subject.

Proposed Separate Car Legislation in Georgia

There is much discussion throughout the State of Georgia regarding the separation of the whites and blacks in the street cars, and the Macon grand jury has prepared a memorial to their representatives in the Legislature recommending that they introduce and endeavor to have enacted a law requiring all dummy, electric and street railways to provide separate or compartment cars for the white and negro passengers, so as to prevent the commingling of the races and to provide for the indictment and punishment of the president and general manager, or officers in charge, of such railways violating this law, as well as the employees of such railways in charge of the cars in which such violations occur.

Freight Service for Providence

The Union Railroad Company, of Providence, R. I., has secured the services of a man who has had a long experience in freight traffic to look over the territory occupied by its lines and the lines of the Rhode Island Suburban Railway Company, and submit a general scheme for connecting manufacturing plants and business houses with the steam road and steamship wharves. The company has been in consultation with the principal manufacturers of the city, and the universal opinion is that the electric locomotive should supersede the horse.

Shippers have been asked to give an approximte estimate of the number of tons handled, and to say what proportion goes by rail and boat. This will enable the company to determine about the number of freight cars needed. The idea is to have one car do the work of six two-horse wagons. The company has invited suggestions and opinions from all interested.

The Populations of Cities

The populations of some of the principal cities of the United States for 1900 are given herewith, as disclosed by the census. Comparisons are made with records of 1890, and the total increase and increase per cent are given in every case:

	1900	1890	Increase	Per Cent
New York	3,437,202	2,492,591	944,611	37.90
Chicago	1,698,575	1,099,850	598,725	54.43
Philadelphia	1,293,697	1,046,964	246,733	23.57
St. Louis	575,238	451,770	123,468	27.33
Boston	560,892	448,477	112,415	25.06
Baltimore	508,957	434,439	74,518	17.15
Cleveland	381,768	261,353	120,415	46.07
Buffalo	352,219	255,664	96,555	37.77
San Francisco	342,782	298,997	43,785	14.51
Cincinnati	325,902	296,908	28,994	9.77
Pittsburgh	321,616	238,617	82,999	34.78
New Orleans	287,104	242,039	45,065	18.62
Detroit	285,704	205,878	79,828	38.77
Milwaukee	285,315	204,468	80,847	39.53
District of Columbia (including Washington)	278,718	230,392	48,326	20.98
Newark	246,070	181,830	62,240	35.33
Jersey City	206,433	163,003	43,430	26.64
Louisville	204,731	161,129	43,602	27.06
Minneapolis	202,718	164,738	37,780	23.05
Providence	175,597	132,146	43,451	23.88
Indianapolis	169,164	105,436	63,728	60.44
Kansas City, Mo.	163,752	132,716	31,036	23.39
St. Paul	163,632	133,156	30,478	22.89
Rochester	162,435	133,896	28,539	21.31
Denver	133,859	106,713	27,146	25.44
Toledo	131,822	81,434	50,388	81.88
Allegheny	129,896	105,287	24,609	23.37
Columbus	125,560	88,150	37,410	42.44
Syracuse, N. Y.	108,374	88,143	20,231	22.95
Omaha	102,555	140,452	*37,897	*26.98

*Decrease.

New York Meeting of the A. S. M. E.

The forty-second meeting of the American Society of Mechanical Engineers will be held in New York, Dec. 4-7. The meeting will be opened at 9 p. m., Dec. 4, at the society's parlors, and the president will deliver his annual address. On Wednesday, Dec. 5, the society will hold three sessions, morning, afternoon and evening. The morning session will be devoted to business, after which the following papers will be presented: "Comparison of Rules for Calculating the Strength of Steam Boilers," by H. de B. Parsons; "A Record of the Early Period of High-Speed Engineering," by Charles T. Porter; "Steam Engine of Maximum Simplicity and Highest Thermal Efficiency," by Robert H. Thurston.

The afternoon will be devoted to renewing old acquaintances and general social intercourse. The evening session will be devoted to the presentation of the following papers: "Note on Centrifugal Fans for Cupolas and Forges," by William Sangster; "Power Plant of the Massachusetts General Hospital," by F. W. Dean; "The Construction of Contracts," by R. P. Bolton; "An American Central Valve Engine," by E. T. Adams. On Thursday the society will be the guest of Columbia University. President Low, of the university, will receive the members, and luncheon will be served in the engineering building. After luncheon the mechanical laboratories will be inspected, and the locomotive Columbia, as well as the Allis experimental engine, will be inspected. The entire university plant will be thrown open to the visitors. Four papers will be presented at the morning session on Thursday, and in the evening the members will be tendered a reception by the president and president-elect. The closing session will be held on Friday morning, when five papers will be presented.

Municipal Ownership in Chicago

The following most interesting editorial appeared in the *Chicago Chronicle* of recent date, relative to the proposed municipalization of the local electric railway lines:

"As far as Illinois and Chicago are concerned, there is nothing practical in the discussion regarding public ownership of street railways, gas plants or other public utilities. Under the present constitution the State cannot loan its credit nor raise a tax for any work of public improvement without a vote of the people. The people never will vote for such a measure.

"As to Chicago, municipal ownership is equally impracticable. The city cannot contract a debt which would be necessary if its power was to be exercised for the purchase or construction of street railways or gas plants or any other public work of general utility. There is an impassable stone wall in the way of any project by which the State of Illinois or the city of Chicago might become proprietor of railways or supplant existing corporations of any kind, private, quasi-public or public. Neither the State nor the city has the money or can obtain the money necessary for the purpose.

"If it was practicable for the city of Chicago to own and operate the street railways and other public utilities it would be inexpedient. Unless a thorough civil service system was established—better as a system and better administered than any national, State or city civil service now in existence—the administration of the public utilities would be pervaded by extravagance, by favoritism, by the worst evils of the spoils system, by inefficiency, probably by corruption.

"We can imagine the riot which would occur in the appointment of all the officers and employees in the street railways, for instance. Not fewer than 18,000 or 20,000 voters are in the service of the present street railway corporations. If all these men held merely political places they would rule the elections in the city and in Cook County. They might rule the State.

'The favoritism which might be practiced if the city should build and operate street railways would be appalling. Lines would be constructed in all directions to 'develop' property or to serve private interests in other ways. Cars would be run on time tables arranged for private accommodation. The street car system would be used for party, personal and private ends, not for public ends.

"These are practical considerations, entirely disconnected from a discussion of the socialistic principles on which the theory of municipal ownership is founded. They are conclusive against all schemes of municipal ownership under our constitution and laws. The people are opposed to revolution."

The Success of the General Electric Company

An interesting example of the present abounding prosperity is furnished by the condition of the General Electric Company. The stock of this company has recently increased as much as 5½ points in one day, but this has been due to a perfectly healthy rise in its value, and not to manipulation by speculative interests. It has been greatly accentuated by the fact that but little stock is to be had in the open market, and that the activity has been confined to small orders. The public has but recently taken an interest in the affairs of this company, remembering only the conditions existing a few years ago, when it was engaged with a deficit, so that there is at present a widespread demand from outside sources for all the stock that can be obtained, owing to the general awakening to its true value.

The attention the stock has been receiving on the New York Stock Exchange, and the surprise of the people who have begun to realize the profitable course of its business during the last few years, have been largely due to the report of its condition made by the company in connection with its application for the listing of $4,415,000 of additional common stock, which is to be used in the taking up of the outstanding debenture bonds. The report to the governors of the Stock Exchange shows on a seven months' basis (the period covered by the report) that the company has an earning capacity of something like 30 per cent per annum. The report is for the period subsequent to that covered in the company's last annual report, or from Feb. 1 to Aug. 31 of the current year. The October dividend of the company was at the rate of 8 per cent, but prior to that the dividend had been 6 per cent. It appears that the present dividend might have been paid in any year of the last five years, and that the company is earning now about four times the present dividend rate.

The profit and loss account for the seven months referred to is as follows:

Sales of goods	$14,803,383.83
Expenses	11,810,999.86
Profit	$2,992,383.97
Royalties, etc.	492,590.00
Total profit	$3,484,973.97
Interest, preferred dividend, etc.	264,995.36
Surplus	$3,219,978.61
Paid on common six months (3 per cent)	548,280.00
Balance (equal 14.6 per cent)	$2,671,698.61

In other words, the company earned on the common stock in seven months 17.6 per cent, equal to a trifle over 30 per cent per annum. The sales of the company last year mounted to $22,379,463. At the rate of sales for the seven months of this year the total sales for the year will be something like $25,223,000.

Its position on Aug. 31 as to assets and liabilities shows:

Capital assets:		
Plant and factories		$3,896,748.05
Patents and goodwill		2,000,000.00
Securities and real estate		7,119,937.40
Total capital assets		$13,016,685.45
Deduct preferred stock	$2,551,200	
Debenture bonds	5,298,000	7,849,200.00
Balance capital assets		$5,167,485.45
Current assets:		
Cash		$2,310,314.74
Notes and accounts		7,379,836.46
Work in progress		1,527,337.86
Inventories		7,788,893.56
Total capital and current assets		$24,173,868.07
Deduct accounts payable		873,138.94
Net capital and current assets		$23,300,729.13
Common stock		18,276,000.00
Profit and loss surplus		$5,024,729.13

Electric Traction on Steam Roads*

The Société Italienne des Chemins de fer Méridionaux, which operates the Italian government steam railroads in the Department of the Adriatic, has devoted considerable attention to the use of electric power on its lines, one special reason being the fact that throughout the territory traversed by its system there is a large number of water powers, and it was hoped that these could be utilized for use on some of its feeder lines through the employment of electricity. The electric traction experiments made by the company have been of two kinds. For certain lines where the traffic was considerable and the train service sufficiently frequent, the company has adopted the direct distribution system by means of a central station and overhead lines. For other lines, where the traffic was quite small, but where it was thought that travel might be increased by a more frequent service, a number of accumulator cars has been run. Experiments have been carried out not only to determine the value of motive power, but also whether by means of it, or at the same time, the company could make a reduction in its train force and station attendants. The system of direct distribution from a central station will first be considered.

DISTRIBUTION FROM A CENTRAL STATION

This is soon to be in use on the Lecco-Sondrio-Chiavenna division, a single track line which has a length of 109 km. The maximum grade on this line is 2.2 per cent. The minimum curve radius is 300 m, and there is a large number of tunnels. The traffic is considerable throughout the year, as the region traversed is essentially an industrial one. The line is operated entirely by electricity.

The passenger trains will be drawn by a 300-hp motor car, which has a weight of about 50 tons, and is capable of carrying sixty passengers, as well as carrying 2 tons of baggage and of drawing four ordinary cars at a speed of 60 km an hour on grades of 1 per cent. For grades higher than this the speed is 30 km per hour. The freight trains will employ a 600-hp electric locomotive, with a draw-bar pull of 250 tons, and having a maximum speed on grades of 1 per cent of 30 km per hour.

The electrical installation is being made by Ganz & Company, of Buda-Pest, and three-phase current will be used for distribution and by the motors. The power station is at Morbegno, and is operated by water power. There are ten sub-stations, which receive current from the main station at 20,000 volts. The transmission line consists of three conductors with a diameter of 7 mm. At the sub-stations the voltage is reduced to 3000 volts by transformers, at which pressure it is distributed to the motors along the line by two wires of 8 mm diameter, the third conductor being formed by the rails. Two trolley wires are suspended 6 m above the rails, except in the tunnels, where they are lowered to a height of 4.50 m above the rails. They are supported in turn by the steel span wires, which are attached to poles or eye-bolts anchored in the masonry, with a second insulation of porcelain in the span wire. Wooden poles are used in the open line.

The power station contains four 2000-hp units, alternators being direct-connected to the turbines. The former supply current at 15 cycles. The head of water is 30 m.

The trolley used on the car is of a special form, and consists of a light metal frame work, carrying on its upper part two rolling contacts. The pole is kept pressed against the overhead wire by a double system of springs, which is controlled by pneumatic means from the motorman's cab. The air pressure is supplied by a Westinghouse air pump. The current at 3000 volts is taken directly to the motors, the rotors of which are provided with liquid rheostats. Each car is fitted with four motors and a series-parallel controller, capable of connecting the motors either two in series or all in parallel. Under the former conditions the speed is 30 km, and under the latter 60 km per hour. To avoid any possibility of the introduction of a high potential in the car, the motors are metallically encased, and this case is grounded. The system, as described, has been employed at Buda-Pest on a line 1600 m in length during December, 1899, and will be put in operation on the Lecco-Sondrio-Chiavenna line during the spring of 1901. The generators have been supplied by Schuckert & Company, of Nuremburg. The rest of the work is being done by Ganz & Company.

THE ACCUMULATOR LINE

The line to be equipped with accumulators is that between Bologna and St. Felice, and has a length of 84 km going and returning, with a maximum grade of 0.6 per cent. The freight traffic is carried on by steam locomotives, as there is only sufficient freight for the operation of one train per day. The transportation of passengers and baggage is effected by four motor cars. Each car seats sixty passengers, and weighs 45 tons when loaded. The battery charge is sufficient to run the cars 100 km. Each car is equipped with two Ganz 50-hp motors. The type of accumulator used is the Pescetto. Each car carries 280 cells, each composed of eight positive and nine negative plates. The weight of each cell is 24 kg, and its capacity is 148 amp. hours. The batteries are in groups of three, which can be used in series or in parallel. When in series the speed of the cars is 45 km per hour, and when in parallel 75 km. The cars are equipped with Westinghouse air brakes.

* Paper read at the International Railroad Congress, Paris, September, 1900.

The Taxation of Street Railway Franchises*

BY TIMOTHY S. WILLIAMS, VICE-PRESIDENT OF BROOKLYN RAPID TRANSIT COMPANY

I am glad of the opportunity which the invitation of your club affords me to speak upon the subject of taxation from the point of view of a corporation enjoying numerous and valuable public franchises. The Brooklyn Rapid Transit Company is the largest taxpayer in the Borough of Brooklyn, and with three or four exceptions the largest taxpayer in the entire Greater New York. It, therefore, has a very live interest not only in the expenditure of public money, but in the proportion of that expense which it pays. The company's policy and practice is to bear cheerfully and to pay promptly all taxes lawfully assessed against it, but to resist those which it believes are illegal, excessive and inequitable. It is a matter of no small gratification to the company's present officers that in the five years of their connection with the company not a single tax has thus far been resisted which the courts have not subsequently set aside or reduced in vindication of the company's action.

Taxes upon corporations are of so many kinds that few persons have any appreciable idea of their aggregate amount. The Brooklyn Rapid Transit Company paid last year in direct taxes to city and State $737,000, and in indirect taxes to the city as part of the burdens imposed upon its franchises an additional sum of $305,000, a total amount of $1,042,000. This was nearly 10 per cent of its gross earnings, and it was nearly three times the amount of the year's profits. For every dollar placed to the credit of the company's stockholders $3 went to the credit of the city and State. Nearly $2,900 a day had to be set aside for the expense of government! The average profit per cash passenger after paying operating expenses and interest on cost was only six-tenths of 1 cent, and it, therefore, required the carrying of 483,000 cash passengers every day in the year in order to yield profit enough to pay the company's taxes.

NO FICTITIOUS CAPITALIZATION

But lest somebody may criticize that these figures are large because of the great proportion of expense which goes to pay interest on what is called fictitious capitalization, I will answer that even if there was no interest to pay whatever—if tracks and franchises and power houses and cars and real estate were all created for us by some good fairy and entailed not a single coupon or a guaranteed dividend check—still it would be necessary for us to carry 145,000 cash passengers every day in the year to give us money for our taxes. But no fairies are making free presents of such properties, and that part of our expense which represents interest on cost of properties is as legitimate as the employees' wages, and to-day you could not duplicate the properties for many millions more than the par value of the stocks and bonds whose interest swells the cost of carrying passengers. That capitalization represents investments extending over forty-seven years; and yet, at the end of the forty-seventh year, out of an enterprise which has been the foremost factor in Brooklyn's growth, and whose development has added hundreds of millions to the values of city and suburban property, for every $3.62 which was earned for the investors (stockholders and bondholders representing forty-seven years' capitalization) one dollar was earned and set aside for city and State treasuries.

From these figures you will see that instead of the people complaining, as we occasionally hear them, that the company is instituting economies in the operation of its railway in order to pay dividends on so-called "watered stock," they might better complain that we are obliged to reduce unprofitable car service in order to have money enough left to pay our taxes. If the city and State would relieve us from the burden of paying taxes and would share with us the cost of new improvements and extensions, I think our stockholders would be quite willing to divide with them equally all the net profits of operation. The fact is that all the net earnings of last year, after paying operating expenses and taxes, were less than 6 per cent of the total cash invested in the properties from their origin to the present time, and those who talk about "watered" stock do not tell what is the truth—namely, that every outstanding bond on our entire system represents its par value in property, and every share in Brooklyn Rapid Transit stock has behind it in actual cash investment considerably more than its present market price.

SOME THINGS THE PEOPLE FORGET

Increase in corporate capitalization excites attention and frequently adverse criticism, but decapitalization passes unnoticed. People note the great prosperity of a few exceptionally favored transportation lines, and deduce extravagant generalizations from the experiences of these few; but they forget or overlook the very much larger mileage of tracks into sparsely settled districts, the competition for sufficient revenue to pay operating expenses, taxes and interest, the foreclosures and reorganizations, sometimes the selling for non-payment of taxes, the assessments of stock and bondholders, the reductions of interest charges, and finally the absorption and support of the weaker by the stronger companies. It has been this process of decapitalization which has finally brought substantially all of the railroad properties of Brooklyn under a single management. The latest efforts at reorganization just before acquisition by the Brooklyn Rapid Transit Company reduced the bonded indebtedness over $5,000,000, and the annual fixed charges over $600,000, and the $25,000,000 of added Brooklyn Rapid Transit stock took the place of nearly $40,000,000 of stock of the absorbed companies. The consolidation of properties was a business risk, inspired by the hope that with reduced fixed charges and with the economies which were expected from joint operation the combined properties could yield profits instead of losses, and, by multiplication of facilities, still further expand the growth of the city. The very first result of these reduced charges and economies has been that railroads which for years had failed to pay their taxes are now contributing largely toward the expenses of State and city government. The first, and as yet the only, beneficiary of our economies, therefore, has been the city treasury.

Tax reform is too often an attempt to shift burdens from one set of shoulders to another or to furnish revenues for extravagant officeholders to spend, and inasmuch as all taxation is unpopular in proportion to the number of people it affects, the tendency of the legislative mind is to restrict new taxation to as narrow a field as possible. Consequently, instead of assessing property uniformly and equally, legislators have devised special burdens for the unfavored few, until to-day the dead, the bibblers and the corporations pay substantially all the State expenditures, and if the latest effort at tax reform is successful the corporations alone will pay a very large proportion of the cost of city government. The dead cannot cry out in protest, the bibblers are ashamed to, and the corporations are too often afraid that protests will only bring fresh burdens in the shape of official oppression or political blackmail.

HEAVY SPECIAL BURDENS

These spasmodic and one-sided attempts to divide and distribute the cost of government have fallen with particular weight on corporations enjoying public franchises, and their results on street railway companies are well illustrated by the obligations, direct and indirect, which are now borne by the Brooklyn companies. In the first place, so far as real and personal property are concerned, we are in the same category and on the same level with all other taxpayers, with this exception—that the tax assessor can always find and locate our personal property—cars and motors and trucks and tools and supplies—but he very seldom finds and assesses the personal property of individuals. We pay each year on our power houses, our car houses, our lands, our tracks, our elevated structures and all our other kinds of real property over $330,000 a year. Thus far we are on an equal plane with other property owners. Beyond that our payments are special burdens —imposed because we are corporations and because we occupy public streets. These special burdens began in 1853, when we were charged with certain paving obligations, and a license fee for every car operated, and although that car license fee was declared to be "in full satisfaction for the use of streets," and although we believe this declaration, confirmed as it afterward was by legislative act, constitutes a contract which, if insisted upon, would relieve us from many later purely franchise taxes, we have borne without active complaint each additional burden until the latest crowning imposition contained in the so-called franchise tax of 1899 has forced us to cry out in protest and to appeal on grounds of law and equity to the courts and to the people.

Without considering the effect of the new franchise tax at all, we are paying directly and indirectly over $700,000 a year in what are purely franchise taxes. There are two kinds of franchise taxes —one the tax which a company pays for the privilege of being a corporation, and the other tax which it pays for its occupation of public streets and places; but the Legislature had confused the two long prior to the adoption of the new franchise tax law. Otherwise it would have treated all corporations alike. Charters are largely free; no special legislative acts are longer required; any set of men can get together, and upon complying with certain formalities and paying the incorporation fee become a corporation. But the Legislature has said that certain kinds of corporations enjoying public franchises, like gas and electric and street railway companies, shall pay a much larger tax for

* Paper read before the Municipal Club, of Brooklyn, Oct. 23, 1900.

the privilege of doing business under a corporate name than other kinds of corporations, and there is absolutely no justification for this discrimination except upon the theory that the tax is based upon the occupation of public streets and places. For this privilege, therefore, our companies paid to the State last year over $200,000. We paid to the city for the privilege of carrying the people across the Brooklyn Bridge without extra fare, $170,000. We paid in car licenses and percentages to the city over $30,000. And we paid in paving and repairing city streets, in removing snow and ice, in lighting certain streets and public places, and in free transportation of policemen and firemen, over $300,000. All these are franchise taxes, and to impose fresh ones, more than half as large as all the others combined, is a tyrannical exercise of the taxing power, which, if applied to individuals generally, would cause a popular revolution, but if applied and enforced against corporations, will mean for some of them bankruptcy, and for others restriction of improvements, curtailment of facilities, possible reductions in wages and much lessened profits.

THE BEST FORM OF COMPENSATION

But this question of taxing public utilities is much larger than any question of the dollars and cents which go into city or State treasuries. It is a business question, and should be determined by business considerations. Individuals or corporations which receive valuable privileges from a city should make ample compensation, but the nature of that compensation is a problem of statesmanship, of foresight, of municipal benefit, of practical business judgment.

Three general courses lie open as original propositions:

(1) The municipality may remove all obstacles to private initiative and enterprise, and grant franchises in perpetuity under reasonable, but not necessarily contractual, limitations as to rates of fare, car service and taxation; or

(2) It may create and operate at public expense all transportation lines; or

(3) It may reserve the ownership of, or the right to acquire the tracks and franchises, and lease for limited periods and upon conditions which may be agreed upon, the operation of cars to a corporation created for that purpose.

I am frank to admit, considering the tendency of legislation and the increasing public demands, that the third course as an original proposition is the best from the selfish point of view of the corporation. Then the contract between city and corporation would clearly define the powers and rights of each. There would then be no legislative or political attacks, no freshly recurrent tax bills to stimulate economies and frighten stockholders, no sense of obligation on the part of the corporation beyond the terms of its contract, a plain business proposition to make the most money possible during the term of the lease. But from the city's point of view, as an initial proposition, such a course would be fatal to municipal progress and development. It is only to be commended when a city has attained its principal growth, and then with reservations depending upon the particular conditions and the objects to be attained.

PRIVATE ENTERPRISE VS. MUNICIPAL

As between the choice of private construction and operation and municipal construction and operation, assuming for the sake of argument what is not true, in this country at least, namely, that governmental activities are as honestly and economically administered as are private activities, the facts of experience speak more loudly than the words of theory. The transportation conditions of European cities have only to be compared with those of American cities to illustrate in a general way the results of municipal enterprise on the one side and those of private enterprise on the other. Neither in mileage of track to population, in motive power, in equipment, nor in rates of fare for equal distances, do the transportation facilities of European cities anywhere nearly approach those of the foremost American cities. In much-heralded Glasgow, with a population of 800,000, there are only 73 miles of tracks, and the fare is 6 cents for a distance not greater than 6 miles. In Berlin, with a population of nearly 2,000,000, there are only 260 miles of track, and the maximum fare is 7½ cents. In Paris, with a population of 2,500,000, there are only 206 miles of track, and the maximum fare is 8 cents. In London, with a population of 4,500,000, there are only 245 miles of track. And in all these cities the operation of the minimum rate of fare with increased rates for longer distances has congested the population, prevented the territorial growth of the cities, and imposed a higher average rate for the distance than is charged in America, although the wages paid to employees here are considerably higher and the cost of operation thereby greatly enhanced. In Brooklyn, on the other hand, with 1,200,000 people, there are over 500 miles of track, and the longest distance for 5 cents is nearly four times the distance which one can be carried for the same money in any European city.

THE CITY NOT A MODEST PARTNER

I think anybody who has watched the growth of Brooklyn will agree with me that compensation for railway franchises has by no means been limited to the moneys which the corporations have paid into official treasuries. I have shown that for every $3.62 which went to the credit of bondholders and stockholders last year out of the profits of the business $1 went to the credit of city and State. But if I were to point out to you the amount of increased taxes which have each year during the last forty-seven years gone into the city treasury by reason of the increased taxable valuations which have followed the extension of our railways and the voluntary reduction of fare, the savings to the people by the reductions in cost and time of service, and the distribution of millions of dollars every year for wages and supplies, you would agree with me that the city has not been by any means a modest partner in our enterprise—but that for every dollar of profit which has been taken out of all the railways of Brooklyn from their beginning to the present day, the city and its people have received tenfold dollars and more. I had the curiosity to verify one phase of this partnership interest when the franchise tax bill was pending in the Legislature, and for sake of illustration I took from the assessment rolls the valuation for the year 1895 (the year prior to the opening of our Fifth Avenue extension from Thirty-Ninth to Eighty-Sixth Streets) on either side the avenue, computed the tax on this valuation, and then compared both valuation and tax with the valuation and tax for 1899, four years after the line had been in operation, and I found that for every dollar which the company's investment had earned $4 had gone into the city's treasury from the increased valuation.

$2,700,000 SAVED EVERY YEAR TO THE PEOPLE BY THE BRIDGE SERVICE

Another illustration which is still fresh in your memories and which must come home to you every day is the extension of our lines across the Brooklyn Bridge. For that privilege we not only paid to the city treasury, in hard-earned cash, last year, $170,000, but, with an added expense of operation represented by running cars 7000 miles a day more without additional fare, we are saving to the 300,000 persons who daily cross the bridge 2½ cents each, or over $2,700,000 every year, and this after private operation supplanted municipal. But even that is not the full benefit. Ask the real estate men of Brooklyn what has stimulated their business during the last three years, what has trebled and quadrupled the values of suburban lands, what has turned farms into city lots, and increased tremendously the population of the city, and they will tell you that the primary factor in these results has been the extension of trolley lines across the bridge and the cheapened rate of fare which gave Brooklyn her advantage in its competition for householders with upper Manhattan, the Bronx, Jersey and Staten Island. What is the annual tax of $170,000 paid into the city treasury compared with the $2,700,000 a year directly saved to the people of Brooklyn and the millions more which have been added to the value of their property? Well could the city afford to abolish the bridge tax altogether, and to pay a handsome bonus every year to the railways than to have its people deprived of such substantial and far-reaching benefits.

The corporation which I represent is proud to have been so potent a factor in Brooklyn's development, and it never wants to shirk its responsibility for encouraging and continuing Brooklyn's prosperity. But it submits in fairness that Brooklyn is equally interested in and should be equally solicitous for the railway's development and prosperity. You cannot, if you would, and you would not if you could, destroy the partnership which binds our interests with common ties. The relations of corporation to city are reciprocal. You cannot impose hardships and burdens on us without some injury to yourselves. We cannot injure your interests and welfare without injuring our own. We are no suppliants for public favor not deserved—we ask nothing except fair treatment. We are here to build up a legitimate business enterprise, in whose success the city has been in the past, and always will be, the chief participant, and as the city's largest taxpayer, and one of its chief instrumentalities for the city's material good, we ask and have a right to ask the enlightened and liberal co-operation of both its government and its people.

At the solicitation of J. I. Beggs, general manager of the Milwaukee Electric Railway & Light Company, C. W. Wetmore and George R. Sheldon, of New York, directors of the company, recently made an inspection of the company's property. Under the new franchise grant, the company is to make a number of improvements in the property, and Messrs. Wetmore and Sheldon were acquainted with the new work proposed. Mr. Beggs announces that the Racine power house is to be enlarged, and, in fact, virtually rebuilt, owing to increased business. Plans are now being drawn for this improvement.

Electric Traction on the Italian Mediterranean Railroad

The Società Italiana per le Strade Ferrate del Mediterraneo, which operates the two large systems of the Italian Government railways, including that of the northern part of Italy, has recently been making some electric traction experiments. The lines equipped are near Milan, and consist of a main line from Milan to Gallarate, which has a length of 40.3 km of double track with a maximum grade of 0.6 per cent, and an average grade of

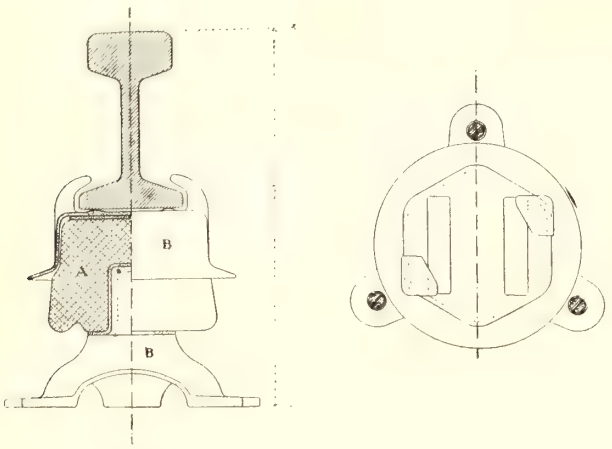


FIG. 1.—SECTION AND PLAN OF THIRD-RAIL INSULATOR

0.2 per cent, and three single track branch lines from Gallarate, having a length of 26 km, 31 km and 33 km respectively. The grades on these branch lines vary from 0.8 per cent to 2 per cent. Electric traction was introduced on these lines in 1898, and has resulted in a large increase of traffic, owing to the greater frequency of the trains. The most desirable train has been found to consist of two long double-truck cars, one a motor car, the other a trail car. The motor car is equipped so as to be able to attain a speed of 90 km per hour on the 0.2 per cent grade. During the season of light traffic and on the branches, motor cars are used without trailers. The train service is as follows: Every hour a train is run between Milan and Gallarate, stopping at all way stations. Twenty minutes after the departure of the way train, a second train is sent out, stopping at only a few of the stations. Fifteen minutes after this train an express train is started out, which stops only at Gallarate, and then continues on one of the branch lines, stopping at all stations. Ten minutes afterward a second express train is sent out, going through Gallarate without stop, and then taking one of the other branch lines. Ten minutes afterward a third express is sent out, which goes out on the third branch line. Passengers from intermediate stations between Milan and Gallarate for any one of the branch lines can take either of the first two trains and change at the latter station for the branch lines. During the year the total number of axle kilometers run on the system was 19,898,340.

ELECTRICAL INSTALLATION

After a study of the different systems of distribution, it was decided to adopt the alternating current of distribution with continuous current motors and the third rail.

The power station is at Tornavento, which is 11 miles from Gallarate, and is operated by water power for the greater part of the year. It contains eight turbines and three compound condensing engines, each directly connected to a 750-kw three-phase generator. There are also two exciters. The generation and distribution is at 12,000 volts, which, at the sub-stations, is reduced to 650-volt direct current by rotary converters. The transmission line between Tornavento and Gallarate is supported on wooden poles with porcelain insulators. Six bare copper wires, each with a diameter of 7.8 mm are employed. The maximum drop on the distribution system is 8 per cent. The insulators are tested to a potential of 40,000 volts. For most of the distance the transmission line is carried alongside of the track, which is on its own right of way. The Wirt lightning arresters are used. The frequency is 25 cycles per second.

The transformers are of the G. E. air-blast type of 180 kw each. Their efficiency is as follows: With full non-inductive load, 97 per cent; with three-fourths inductive load, 96.6 per cent; with one-half non-inductive load, 95.8 per cent; with one-fourth non-inductive load, 92.8 per cent. The transformers are capable of carrying an overload of 25 per cent for one-half hour, and 40 per cent for several seconds. The rotary converters are of 500 and 200 kw each.

THE TRACK

The third rail is a 45-kg (91 lbs.) T, as shown in Figs. 1 and 2, and rolled in 12-m (39-ft.) sections. It is held in an iron clamp supported on a composition insulator, which, in turn, is supported on a cast-iron chair. The rail-joints are connected by a single fish-plate with a flexible copper bond with Chicago terminals. The third rail is fed every 100 m (328 ft.) The third rail is carried outside the service rail at a distance of about 675 mm (3 ft. 2½ ins.). The rails are bonded for the return by the same type of bond as in the third rail.

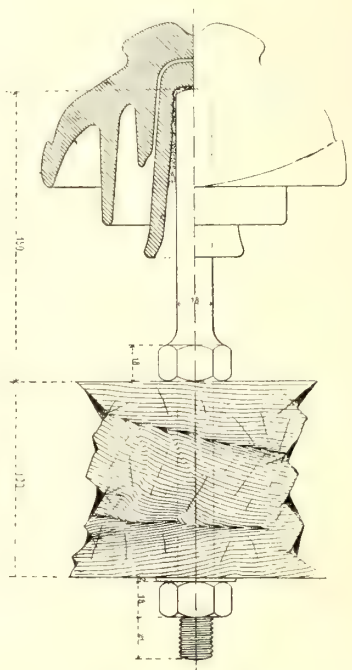


FIG. 3.—LINE INSULATOR

ROLLING STOCK

This consists of twenty motor cars, all of the so-called American type. The car body has a length of 17.89 m (59 ft.), a height of 4.145 m (13 ft. 8 ins.) and a width over sash rails of 2.96 m (6 ft. 5 ins.). Each is divided into two first class, two second class and two third class compartments, making a total carrying capacity of about ninety passengers with sixty-three seats. Each car is equipped with a Westinghouse air brake with motor compressor. There are four motors on each motor car with two series-parallel controllers and four contact shoes, two on each side. The motors are of the G. E. 55-H type, with a rated capacity of 160-hp each.

The steam power station was installed by Franco Tosi, of Legnano, the motor cars by Miani Silvestri & Company, and the electrical equipment by the Compagnie d'Electricité Thomson-Houston de la Méditerranée.

FIG. 2.—SECTION OF TRACK SUPERSTRUCTURE

*Abstract of a paper read before the International Railroad Congress, Paris, September, 1900.

Electrical Traction in Italy

(From Our Special Correspondent.)

According to the latest official count, there are now 1987 miles of street railways in Italy which are operated by mechanical traction. Of this number only 160 miles are electrically operated, and they are distributed as follows:

(1)	Piedmont (City of Turin)	31.26 miles
	Lombardy (Milan and Varese, 3.68 miles)	38.369 "
(2)	Liguria (Genoa and suburbs)	25.65 "
	Tuscany (Florence and Leghorn)	34.24 "
(3)	Umbria (Perugia)	26.65 "
	Lazio (Rome)	17.802 "
	Campania (Naples and suburbs)	4.361 "
	Sicily (Palermo)	6.000 "

The remaining eight provinces—Venice, Emilia, the Marches, Abruzzi and Molise, Apuglia, Basilicata, Calabria and Sardinia—are without electric traction. In fact, the Marches, Abruzzi and Molise, Basilicata and Calabria, though teeming with millions of inhabitants, are without street railway traction of any sort, whether mechanical or animal.

Much is being done, however, to change this condition of affairs, and before long many of the existing lines which are using steam or horses will be changed over to electricity. A number of new lines are being rapidly pushed to completion. The apparatus which will be used on them is of the following makes: Thomson-Houston, Siemens-Halske, Schuckert & Company, Helios, Allgemeine Elektricitäts Gesellschaft, Ganz & Company.

The electric railways now operating in Italy—including those just opened, namely the Palermo-Monreale, built by Schuckert & Company (which presents some rather interesting features); the Sampierdarena-Conegliano (by the Allgemeine Elektricitäts Gesellschaft, of Berlin), and the Musco-Miano, near Naples (4), which is being extended to San Giuliano in Campania—are almost all standard gage and equipped with the overhead system.

The owners of the franchises for a small number of roads which use accumulators have come to terms with the towns in which they operate, agreeing to pay for the right to substitute the overhead system for accumulator traction (5).

The new roads, also, with few exceptions, are standard gage trolley roads. Among them may be cited the Milan-Affari line, which has just abandoned horses for electricity; the Milan-Corsico line, which will do the same thing in a few weeks; the Milan-Monza line (9 miles), which will go into commission about the first of the year as competitor for the traffic which the Mediterranean Railway is now attempting to care for with two storage battery cars (Hensenberger type), with bodies built on the American principle, a description of which has already been given in the pages of this journal.

The city and suburban systems of Catania, now building by the Helios Company, comprises 9½ miles in the city and 10 miles in the suburbs; it will be operated by steam-driven generators, and at 400-volt pressure, the current being used for light as well as power. The suburban system of Spezia is also a Helios outfit. When finished it will have nearly 14 miles of line, and the power plant will contain two 250-hp Tosi compound engines driving generators, and also a battery of accumulators.

Schuckert & Company have under construction some lines in the province of Como. The Thomson-Houston Company is building a line from Ventimiglia to Bordighera, which is to be operated by water power, with a gas plant as a reserve. This line will be extended as far as San Remo. The Allgemeine Elektricitäts Gesellschaft is building a line nearly 9 miles long between Genoa and Voltri.

In addition to the above there is the work being done by the great steam railroad companies of the Mediterranean and Adriatic slopes, who have acquired water-power rights capable of developing an aggregate of 100,000 hp, and who are introducing electricity on the following lines:

Milan-Gallarate-Arona, Gallarate-Varese-Larieno (66 miles), Seco-Colica Sondrio and Colico-Chianenna (68 miles), Bologna-San Felice (26 miles), this last being for passenger traffic only, and to be operated with storage batteries.

The electric railways still on paper can be counted by tens. There are a number, however, that appear to be well under way.

The Fossano-Bra road has begun actual construction, and the Fossano-Mondovi line is about to change over from horses to electricity. Power will be transmitted from Cherasco, where the river Tanaro can be made to furnish about 2400 hp. The work is being done by the Italian Electric Improvement Association, of Milan, and three-phase current at 10,000-volts pressure will be used for the transmission.

At Val Brembana a project for a road is being pushed by L. Magrini, an engineer who proposes to develop about 1000 hp from a fall at S. Giovanni Bianco. A storage battery is talked of for this station.

The line proposed from Samaden to Tirano is an extension of the Campolongo Tirano steam road, which was changed over to electricity. This line is 3-ft. 3-in. gage, and there are some 7 per cent grades; the sharpest curve is on a 130-ft. radius. Direct current at 800 volts will be generated by water power at Mount Paschiano, where it is thought that 3000 hp can be developed.

A company has been formed to construct a line from Vaghera to Varzi, and it has been voted a yearly subsidy of $5,000 for thirty years from the town of Retarbido. It is expected that the company will receive further grants from other towns along the line. Power will be taken from the river Staffosa. The total cost is put at $290,000.

A company bearing the name of Torre del Greco-Torre Annunziata-Castellamare Railway Company has taken over the franchise of the Torre del Greco-Castellamare line.

The Rome-Frascati line is to be operated electrically, and the power plant has already been installed at Ciampino by the Thomson-Houston Company.

The Val Sabbia is to have a long-distance road running from Brescia, through the Edolo and Presseglie valleys into the Val Sabbia, about 4 miles from Vestone; thence, following the Chiese through Vestone and Anfo, and going as far as Ponte Caffaro on the border of the German Tirol.

A company is being formed to build a line from Gadova to Vicenza, to be operated either by steam or electricity; if the latter form of energy be used, power will be taken from the Bracchiglione.

Bergamon and San Pellegrino are also to be connected. A Milanese firm has contracted to furnish electric power at $26 per horse-power. The towns along the line have voted all the subsidies asked by the promotors.

The Camerino-Castelraimondo line (7 miles long) also has been granted a subsidy, which consists of $8,000 for seventy years and $36,800 for a sinking fund.

The line from Bettole di Varese to Luino, being built by the Electric Railway & Tramway Company, of Varese, is 15.3 miles long, and is to cost $397,000. The government has granted a subsidy of $640 a mile, good for thirty years. Thomson-Houston equipment will be used.

In addition to the foregoing, there are quite a number of electrically operated cable roads proposed. This summer one was opened between Saint Vincent, a watering place, and the Fons Salutis Spring.

There are still many lines that have not been mentioned which must, sooner or later, change their methods of traction and adopt electricity. Among these are the systems of Alessandria, Verona, Padova, Bolognia, Bari, Messina, etc. In many of these places, however, progress is blocked by the refusal of the operating companies to listen to the demands of the municipalities. In this connection it is interesting to note that for the fiscal year 1900 the city treasury of Rome will be enriched by some $80,000 as its share in the profits from the street railways of the city; while in Milan the city will receive $200,000.

(1) There are two operating companies in Turin, one of which, the North Italian Company, has contracted to add some 13 miles of double track to its system before 1902.

(2) The earnings for the last fiscal year on the various lines of this system, including the hill lines, worked by electrically driven cables, footed up to $606,989, notwithstanding that the Sturla-Nervi line was in actual operation during a few months at the close of the year only.

(3) The roadbed of this line has grades of 6½ per cent and curves of 42-ft. radius.

(4) The present power plant of the Naples Tramways has three 300-hp steam-driven generators, and is to be increased by the addition of a water-power plant.

(5) The North of Italy Company, in Tunis, has agreed to pay the city for the right to use the trolley system, at the rate of 2/5 cent per car mile and 50 per cent of the net profits.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

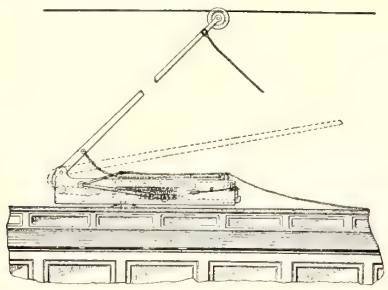
ELECTRIC RAILWAY PATENTS ISSUED NOV. 13, 1900

661,491. Emergency Brake Switch; W. M. Brown, Johnstown, Pa. App. filed Oct. 14, 1898. The invention has to do with the mechanical construction of the switch, with a view to obtaining simplicity, the braking force being the usual "bucking" of the motors.

661,516. Trolley; H. S. Goughnour, Johnstown, Pa. App. filed March 21, 1900. The spring attached to the trolley is auto-

matically thrown out of use when the pole rises above its wire, and this allows the pole to fall to a horizontal position.

661,540. Railway Switch; C. F. Kress, Jr., Johnstown, Pa. App. filed March 19, 1900. The heel of the switch point is provided with a circular enlargement, through which the grooves in the rails are extended, the enlargement forming a support for the pivot pin and rendering it unnecessary to extend the tongue in order to provide for the proper support of the pin.

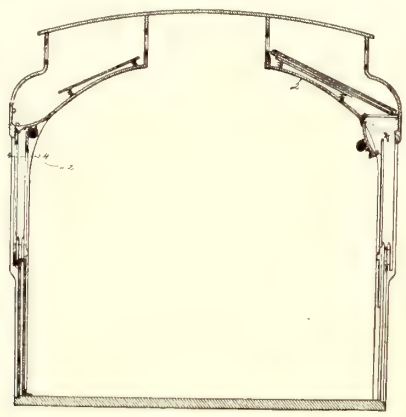


PATENT NO. 661,516

661,572. Air Brake Mechanism for Cars; D. Beemer, Detroit, Mich. App. filed Feb. 25, 1898. The air pump is geared in a special manner to the car axle.

661,600. Trolley Wheel; T. I. Duffy and C. S. McMahan, Chicago, Ill. App. filed July 16, 1900. Contact springs between the harp and the wheel are inserted in a special manner.

661,714. Telephone Circuit; I. H. Farnham and G. W. Davis, Wellsley, Mass. App. filed May 11, 1900. Circuits and apparatus for telephoning between cars and central station. The circuit extends along the road, and is provided with plugging in points where the apparatus on the car can be connected.



PATENT NO. 661,921

661,841. Switch Controlling Device for Surface Cars; C. G. Bauer, New Rochelle, N. Y. App. filed March 26, 1900. The motorman is enabled to force a hook down into a slot in the roadbed for engagement with switch-throwing mechanism located therein.

661,880. Electric Brake Controller; J. C. Lincoln, Cleveland, Ohio. App. filed Oct. 2, 1899. The trolley current is used to excite the fields of the motors when the brake is first applied, and such currents are allowed to flow through the fields after the motors have ceased rotating. This brings the braking force into action at once, and holds the car on a grade after the braking force afforded by the generating motors ceases.

661,921. Convertible Car; J. O'Leary, Cohoes, N. Y. App. filed Aug. 22, 1899. The sash and panels can be moved up into a chamber under the roof of the car.

PERSONAL MENTION

MR. J. B. FISHBURN has just been elected president of the Roanoke Street Railway Company, of Roanoke, Va., to succeed H. S. Trout, resigned.

MR. C. A. BABTISTE has been appointed Western manager of the STREET RAILWAY JOURNAL, vice Mr. C. S. McMahan, resigned. Mr. Babtiste's headquarters will be at our present office, Room 1520, Monadnock Block, Chicago.

MR. JOHN T. CONWAY, the retiring assistant general manager of the Brockton Street Railway Company, was presented with a handsome diamond ring and gold watch chain by the employees of the company a few days ago. Mr. Conway has been in the service of the company thirteen years.

MR. JOHN PILLING, of Newark, Del., president of the American Hard Fibre Company, died Nov. 8. Mr. Pilling was born at Chowbent, England, March 6, 1830, and was compelled to go to work at the remarkable early age of eight years. At the age of eleven years he had served an apprenticeship at making horseshoe nails. His father came to America with his family in 1841, and both father and son worked in various mills until 1848, when they entered the employ of Joseph Dean & Son, near Newark. Mr. Pilling advanced slowly until he received $10 per week for his services, but resigned this position to accept one at a salary of $5 per week, which, however, gave an opportunity to learn the entire business. He later severed his connections with Messrs. Dean & Son to accept a position in Philadelphia, but returned in 1860 to enter partnership with William Dean. This partnership lasted until 1882, when the concern was incorporated, with Mr. Pilling as president and Mr. Dean as treasurer. Mr. Pilling was married twice, and is survived by his second wife and three children by his first wife.

MR. W. E. HARRINGTON, who has recently tendered his resignation as general manager of the Camden & Suburban Railway Company, of Camden, N. J., was born in Wilkesbarre, Pa., June 3, 1866. He is the son of David C. Harrington, an attorney-at-law, and was graduated from the Mechanical Engineering Department of the University of Pennsylvania, with the degree of B. S. in 1887. In 1888 he entered the employ of Keasbey & Mattison, of Ambler, Pa., as a designer, and in 1889 and 1890 supervised the construction of an electric railway at Atlantic City for the Pennsylvania Railroad. In 1891-92, as general manager of the consolidated electric railways at Wheeling, W. Va., he supervised the reconstruction of the lines and entire system. During the next two years he acted as supervising and consulting engineer for a Pennsylvania syndicate, and from 1893 to 1896 acted in a similar capacity for the Camden Horse Railway Company, Camden, Gloucester & Woodbury Railway Company, General Electric Company, Cutter Electric & Manufacturing Company, of Philadelphia, and other companies. While in the employ of the Cutter Company, Mr. Harrington invented and commercially exploited and introduced its entire line of I-T-E circuit breakers. When the consolidation of the electric lines centering at Camden, N. J., was completed in 1896, Mr. Harrington was selected as general manager of the system. The consolidated company is known as the Camden & Suburban Railway Company, and, at the time Mr. Harrington assumed charge, the system comprised 35 miles of track, which was in bad condition, and with no systematic organization. During Mr. Harrington's connection with the company, the entire system has been almost entirely rebuilt, and 16 miles of new track has been laid. A new car house and power station have been designed and built under his supervision, and a park has been laid out. The latter contains a theater, merry-go-round, boats, etc., and has been remunerative to the company. Mr. Harrington has always had the greatest consideration for his employees. He has established a reading room for them, and was instrumental in organizing an association, which holds monthly meetings, and provides instruction and entertainment for them. The service stripe system was also introduced by Mr. Harrington, and a stripe is given for each five years of service. Faithful service is also rewarded by each employee being presented with a uniform after five years of service and each succeeding year until ten years are reached. After completing ten years, and each succeeding year until fifteen years have been completed, the employees are given a uniform and an overcoat. For each year after fifteen years have been served, the men are presented with two uniforms and an overcoat. Mr. Harrington was president of the Electrical Section of the Franklin Institute in 1898, and has been a member of the American Institute of Electrical Engineers since 1889. He has presented papers on engineering subjects before various technical bodies, including the American Street Railway Association. Mr. Harrington has matured no definite plan for the future. He will take a well deserved rest of a few weeks.

W. E. HARRINGTON

Street Railway Journal

VOL. XVI. NEW YORK AND CHICAGO, DECEMBER 1, 1900. No. 48.

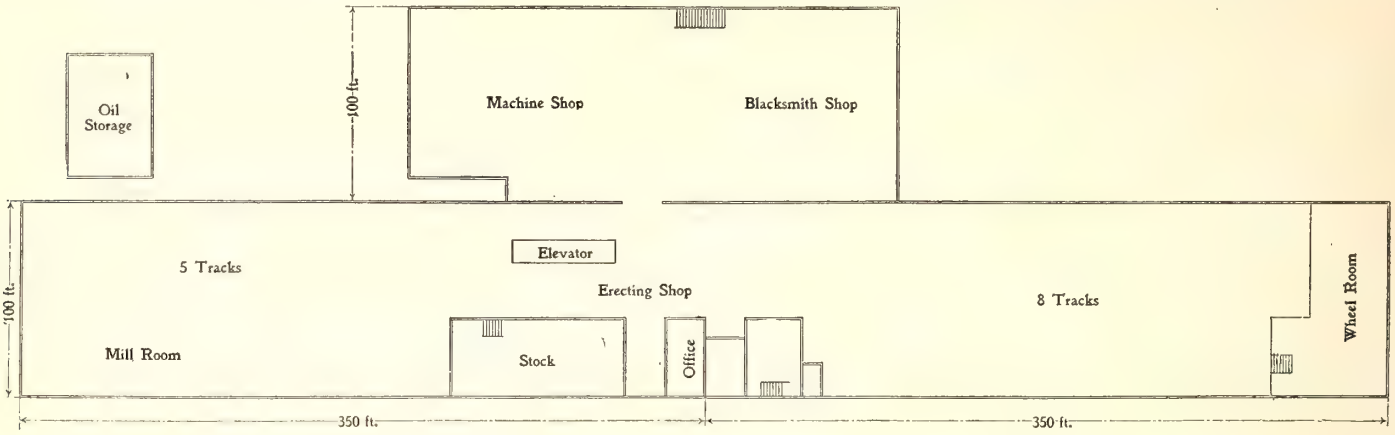
THE REPAIR SHOPS OF THE BROOKLYN RAPID TRANSIT COMPANY

The main shops of the Brooklyn Rapid Transit Company present to-day one of the most complete examples of modern methods in the systematic handling of street railway repairs. The shops are located at Fifty-Second Street and Second Avenue, South Brooklyn, near one of the company's largest power stations. They are the mechanical head of a system of auxiliary repair shops which includes eleven depot shops and four elevated railway shops, the entire system being controlled from the Fifty-Second Street office. During the past year the shops have been thoroughly reorganized and greatly extended, and, although there are still many contemplated additions to both buildings and equipment, the plant as it now stands is of such positive interest that it merits a comprehensive description. The engravings which accompany this article illustrate many of the novel features of the methods used in the shops, and the plans given will enable the reader to thoroughly understand the general arrangement. Two maxims have been adopted by which all work in the shop is guided: One is to move large material as seldom and as short a distance as possible, and the other to never pass the same point twice with any piece of apparatus under repair. The latter is as applicable to a description as to the actual work, and in the following outline of the methods employed the same general order is retained as is followed by the cars and equipments.

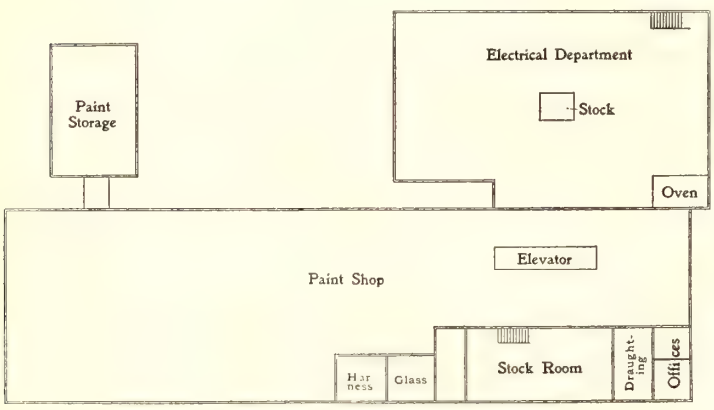
GENERAL VIEW OF ELECTRICAL DEPARTMENT

The cars are run into the shops from the Second Avenue end, there being five receiving tracks, holding from six to nine cars each, in the front part of the main floor, and eight tracks of about equal capacity in the rear portion. There are under construction pneumatic hoists, which are soon to be installed, which will be used to lift the car body from the

trucks. These can then be rolled on to one of the two electric transfer tables running across the shops, and transported to any desired point. The transfer table nearest the receiving tracks will carry the truck to a point midway between the machine shop and the blacksmith shop or forge room, where it can be run over any one of the fourteen repair pits, which is most conveniently located for the supplying of its necessary requirements. Here, the armatures, and, if necessary, the entire motors, are removed and the truck thoroughly renovated, the facilities for heavy repairs being close at hand in the machine shop and blacksmith shop. The latter is equipped with twelve down-draft forges, made by the Buffalo Forge Company, Buffalo, N. Y., which give excellent service. These forges are particularly adapted to work of this kind, as the entire absence of overhead draft tubes allows of much better illumination,

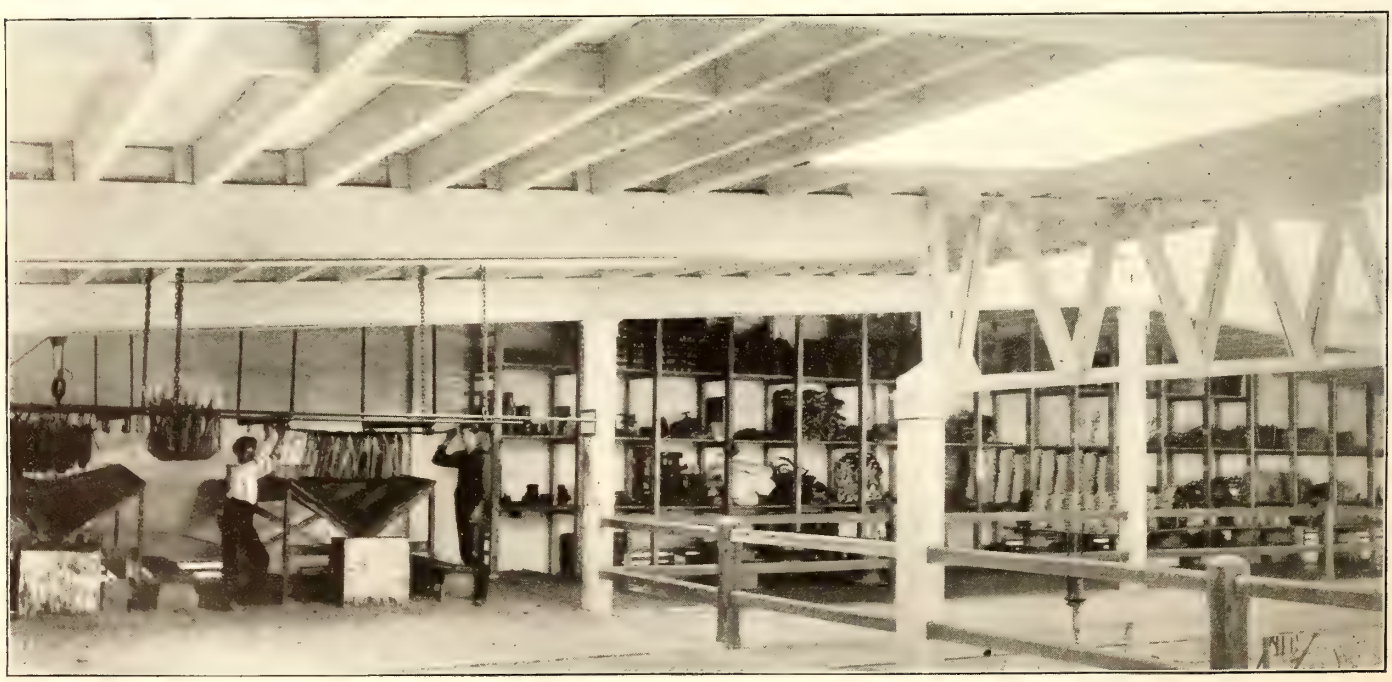


PLAN OF GROUND FLOOR



PLAN OF SECOND FLOOR

A LINE OF FORGES



GALLERY OF ELECTRICAL DEPARTMENT, SHOWING DIPPING VATS AND STORAGE RACKS FOR ARMATURE COILS

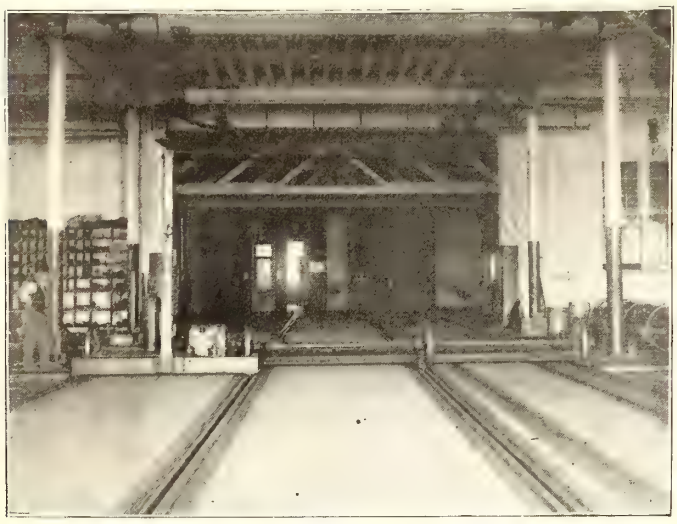
and the efficient regulation of the heat, which can be accomplished by the hood, enables the workmen to turn out the most faultless material. The mechanical draft for these forges, as well as for a large reheater used in bending motor-supporting cross bars, is furnished by the blower and exhauster, which are shown on the suspended platform in the illustrations of this room. These are both driven by a 25-hp General Electric motor. The blacksmith shop also contains a combination punch and shear, which will cut off a piece of iron 8 ins. by 1 in., and will punch a 1¼-in. hole in 1 in. iron. The machine which bends the motor-suspending bars after they leave the reheater mentioned above is known as the "Bulldozer," and its appearance and operation surely merit the name; one man could formerly turn out three bars per day, whereas, by the use of this machine, sixty bars can be easily finished. The shop is completely equipped with steam and trip hammers, shears, punches, etc., so that every variety of repairs can be made. At the other end of the room, on the other side of the transfer table tracks, is the machine shop already referred to. This department contains lathes, shapers, slotters, etc., etc., of the best construction, and capable of handling a great variety of work. The machines are placed in line, and like machines are placed near together in order that one man can attend to two or more similar operations at once, thus rendering possible large economies in labor. Some of the work done in this department is of quite a heavy character, as many of the power station repairs are made in this shop. Among the special machines which are installed may be mentioned multiple drills, which will drill four holes at one operation, and turret and monitor lathes, finishing six operations without further attention as to chucks. The machinists are also employed in fare register repairs. At one side of the shop is a tool room, separated from the shop by a wire net partition; the tools being delivered to the workmen by a check system, which enables the foreman to account for the disposition of every article.

After the armatures and fields have been removed from the motors, they are taken up stairs on electric hoists to the winding room, which is immediately over the forge room. This department is large, light and airy, and the progress of the armature through it is so arranged that no interference or blocking occurs. The armature, after entering the room is thoroughly inspected, and a statement of necessary repairs made. It is then delivered to the winders, who are furnished with two pairs of the armature stands shown in the cuts. These stands are of a peculiar design, and give most efficient service. They consist of a heavy cast-iron base, with the fork and sheaves which support the armature shaft on the end of a longitudinal screw, thus enabling the height of the stand to be readily varied. The box, with which one of the stands of each pair is provided, forms not only a convenient receptacle for the workman's tools, but can be used by him as a rest or seat. It is a great advantage to supply each winder with two sets of stands, as the armatures are tested out thoroughly before leaving the stands, and if only one set per man was provided, he would necessarily lose a great deal of time during the testing op-

VIEWS ABOUT THE MACHINE AND BLACKSMITH SHOPS

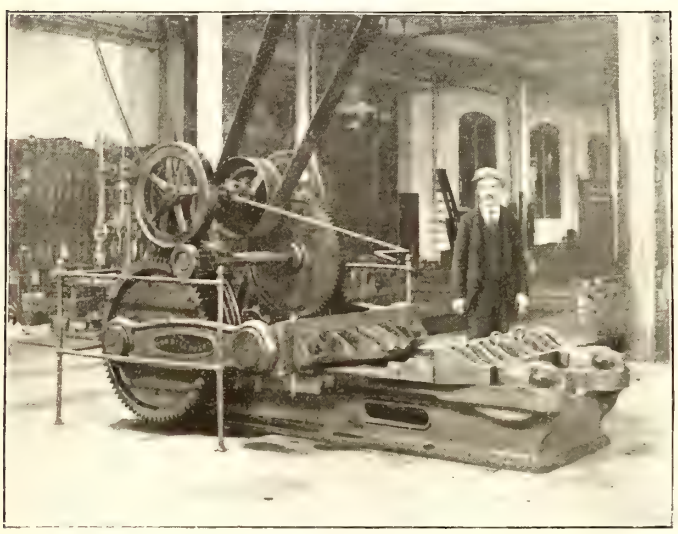
eration. With the present system, however, as soon as he is finished with one armature, he can immediately commence upon another. The armatures are moved about the shop on the carriages shown in the illustration, and their construction, as can be easily seen, is such as to facilitate greatly the handling of such heavy and delicate apparatus. While out of their shells, they are never placed directly upon the floor, but are either on the stands or else in boxes made especially for the purpose. These boxes provide for their safe transportation to any part of the shops or outside.

The coils are all wound in this room on the ordinary style of machines. After being wound they are placed upon a carriage, and conveyed by a hoist and overhead track to the dipping vats, which are placed upon the gallery of the room. The floor of the gallery, in the neighborhood of these vats, is covered with sawdust, which entirely pre-



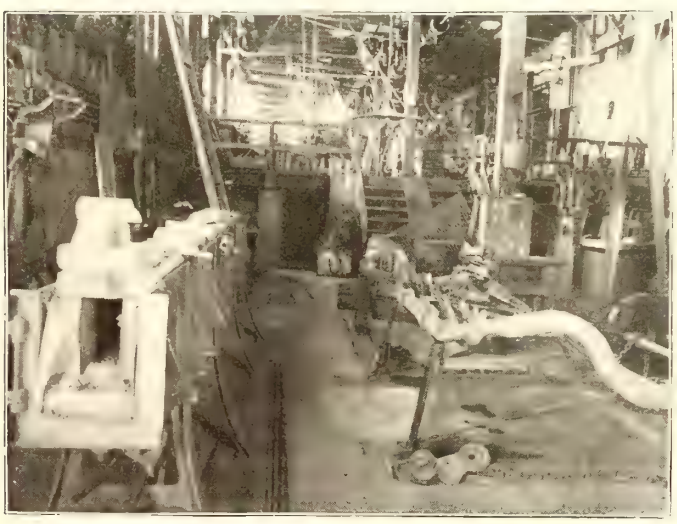
ONE OF THE TRANSFER TABLES

HAMMERS IN BLACKSMITH SHOP

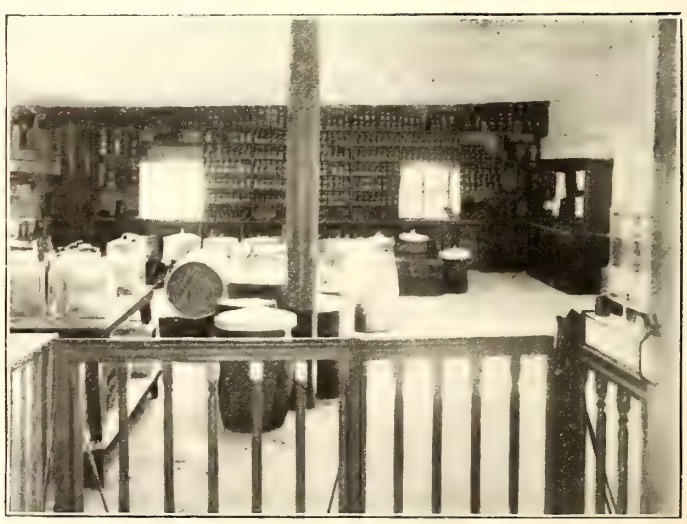


THE BULLDOZER

METHOD OF MOVING ARMATURES



FENDER BENDING MACHINE AND ELECTRIC HEATER



PAINT STORE ROOM

vents the workmen from tracking the insulation about the buildings. Both armature and field coils are placed in racks or separate divisions of the floor of the gallery, arranged according to their various types and sizes. Thus, when an armature is to be repaired, it is very easy to obtain the correct coils. In this room also are repaired controllers, resistance boxes, etc. On all the tables and benches are testing wires, the terminals of which have a potential of 500 volts. This enables the operator to quickly prove his work, and prevents him from allowing short circuits or other defects in the apparatus from being covered up as the work proceeds, with the consequent repetition of the repairs.

REPAIRING ARMATURES

The baking oven in one corner of the room is sufficiently large to never hold the work back, and is kept continuously at a temperature of 200 deg. F., which is produced by steam pressure of 60 lbs. in a system of heating pipes. In the center of the room is an auxiliary stock room, which is supplied every three days from the main stock room with materials likely to be used in this department. The top of the racks in which this auxiliary stock is kept is used by the foreman as his office. He thus not only keeps directly in touch with the distribution of material, but at the same time has a comprehensive view of his entire force of workmen.

Returning now to the car bodies, which have been lifted from the trucks by pneumatic hoists on the receiving tracks, a description of the mill room, which is adjacent, is in order. This shop contains cut-off saws, planers, etc., the machines being staggered so as to prevent, as far as possible, interference of the long pieces of lumber which it is desirable to handle. The floor of the mill is made of concrete, and a rotary blower furnishes an exhaust for the blowing out of shavings and sawdust. The power for the machines is furnished by a 100-kw Edison, bipolar, undertype motor, which is enclosed in a wooden closet or box in the center of the room. This box is so made that in case of an accident to the motor its sides can be readily detached from one another, and falling out, leave it entirely exposed.

After the motor parts have been returned to the trucks and the latter painted, it is run under the car body, and the complete car taken to the paint shop on the floor above the receiving tracks. This is accomplished by an electric elevator, which delivers the car to an electric transfer table, from which it can be run on to the most convenient track of the paint shop. Overhead trolley wires are provided so that the car is run by its own power. Adjoining the paint shop is the "harness" shop, where all leather work, such as repairing window curtains, hand straps, etc., is done, and the glass shop.

Near the offices, which are situated about the center of the main building, are the men's locker rooms, and above them the pattern room. This latter, as well as the blue-print and draughting room, is in charge of Charles Peterson, and a complete system of receipt tags is employed for accounting for each pattern. Behind the locker room is the foundry and wheel room, which also contains the fender bending machinery, shown in one of the views. This machine bends the steel tubing for the fender in one operation, taking it from the electric furnace shown on the left, which has heated it to redness.

The following is a list of the tools in the different departments:

Blacksmith Shop.

1 steam hammer.
1 trip hammer.
1 combined punch and shear.
1 separate power shear.
1 separate power punch.
1 "Bulldozer."
2 drills.

Machine Shop.

1 multiple drill.
1 power punch, shear and die cutter.

WINDING AND TESTING ARMATURE COILS

1 automatic hack saw.
11 lathes.
1 monitor lathe.
3 shapers.
3 automatic tool grinders.
2 planers.
4 milling machines.
9 drills.

4 bolt cutters.
3 double-spindle sensitive drills.

Mill Room.

1 swinging cut-off saw.
2 surface planers.
3 slitting saws.
2 molders.
1 jointer.
1 sandpapering machine.
3 gang saws.
1 single spindle shaper.
1 double spindle shaper.
2 vertical mortising machines.
1 hollow chisel mortising machine.
2 tenoning machines.
2 side lathes.
2 knife grinders.
2 boring machines.

Wheel Room.

1 axle lathe.
2 wheel boring machines.
2 hydraulic presses.

The stock room, under the charge of W. J. O'Connor, contains everything which is required for the entire Brooklyn system. It is, in fact, the main storage for the Fifty-Second Street repair shops, as well as for the fifteen auxiliary shops distributed throughout the city. The system of accounting is most complete, and the arrangement of the stock has been greatly simplified. Heavy stock, such as gears, iron castings, etc., are received in a yard adjoining the shop, which is surrounded by bins. This yard is tracked and floored so that either cars or wagons may be used to deliver the material. In the center of the yard is a fireproof, brick, two-story building, the first floor of which is used for lubricating oils, and the second story for paints, varnishes, etc. A complete system of overhead tracks and differential pulley blocks facilitates the handling of the heavy oil barrels. Lumber is racked according to size in an adjoining yard, a large stock being always on hand. Scrap is all carried to a location convenient to the street, and is removed from the premises daily.

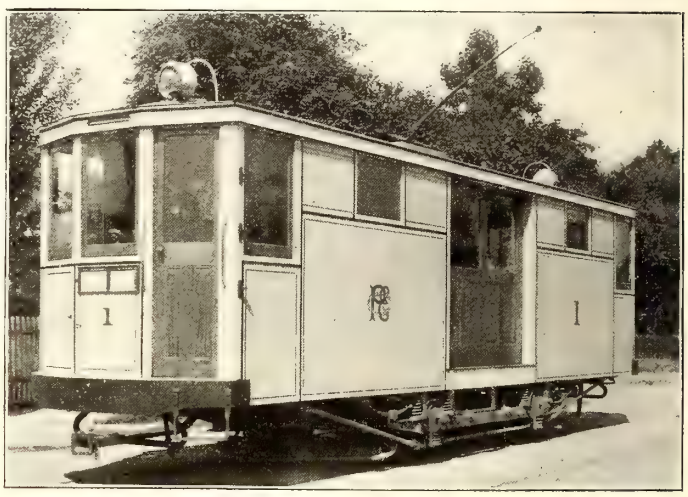
The work done in the shop is almost entirely on the piecework system, only the laborers who are used for transferring apparatus from one part to another being paid by the day. The satisfactory operation of this system is largely due to the care taken to never enforce idleness upon a workman, nor to have one employee delayed by the operation of another. The precautions taken to avoid danger from fire are most complete. Fire plugs are distributed throughout the buildings, upon which weekly tests are made, and these plugs are manned by three workmen when an alarm of fire is turned in.

The entire work of reorganizing the shops was planned by Eugene Chamberlain, superintendent of equipment, and has been carried out under his personal supervision. Mr. Chamberlain's long experience in steam railroading has given him a thorough understanding of the value of detail and small economies, and in every part of the shop one finds typical examples of efficient management, giving to one of the largest street railway systems in the world the means of repairing and renovating its cars and equipments in a systematic and efficient manner.

The Street Railway Express Service in Pittsburgh

The Pittsburgh Express Company, Pittsburgh, Pa., is now conducting an electric express car service with most satisfactory results. There are at present in operation ten cars of the type shown in the accompanying engraving, which have a capacity of 8 tons each. The length of the cars is 29 ft. 10 ins. over all, and they are equipped with a single truck, having 7½-ft. wheel base and 33-in. wheels, with 3½-in. journals. This car has a solid bulkhead in each end, thereby forming a vestibule, or cab, for the motorman and messenger, which is necessary to avoid the shifting of the load on heavy grades. The style of car adopted suits the purpose, and gives good results in operation. However, as the main problem is always to cheapen the cost of transportation, if the conditions are such that double-truck cars can be used advantageously, and the traffic of such a character as will warrant it, a car of greater length would be more desirable, as it gives greater capacity and reduces the cost of operation.

The company is now making an average of sixteen round trips per day to seven different terminals, at distances of 7 miles to 14 miles, and a total daily mileage of 270 car miles,



PITTSBURGH EXPRESS CAR

or 7020 car miles per month. It handles both express packages and heavy freight of all kinds. Packages that are collected by the company's wagons and delivery completed at destination by wagon are classed as express, while goods that are brought to the station and are either called for at destination station or delivered along the line from the car, are classed as freight. There is a central downtown warehouse, equipped with offices, high platform, and a double track running into it, where the express that is collected by the wagons is received and loaded into cars, and also where shippers deliver their freight for forwarding by car to different points reached. Other stations at certain points in the city, as well as in the surrounding towns, are supplied with wagon equipment, and make delivery and collection within certain limits. The express rate is about the same as is charged by regular express companies operating over steam railroads, and runs from 20 cents to 35 cents per 100 lbs., according to the distance hauled, and for packages less than 100 lbs., the rate is graduated to a minimum of 10 cents. All express and freight are receipted for in accordance with the ordinary practice of express and freight companies, and are manifested, and a receipt taken from consignee in the usual way. While the schedule provides for as many regular trips as the traffic warrants, special cars are sent out any time when there is a carload.

On level and through runs, when there is not too much local street delivery, express trailers can be operated satisfactorily, even during the busy part of the street car day, and for night runs their use is a great aid in reducing the cost of transportation. C. V. Wood, general manager of the Pittsburgh Express Company, has taken a great interest in this work, and it is largely due to his efforts that the system is in its present successful state.

The Fond du Lac Street Railway and Light Company

The city of Fond du Lac, Wis., in June, 1900, had a population of some 16,000, but those figures by no means indicate the city's future. The location of the Wisconsin Central car shops there has given the place an impetus such as few towns of its size ever get, and will probably insure a population of from 20,000 to 25,000 in the next decade. The car shops' plant, when completed, will be among the finest in the United States, if their size be taken into consideration. Before work was commenced on them great care was taken to have the plans as near perfect as possible, that every up-to-date feature of value might be included, and, as a result, the shops will be models in every way. This fact testifies to their permanency in this locality and their beneficial influence on the town.

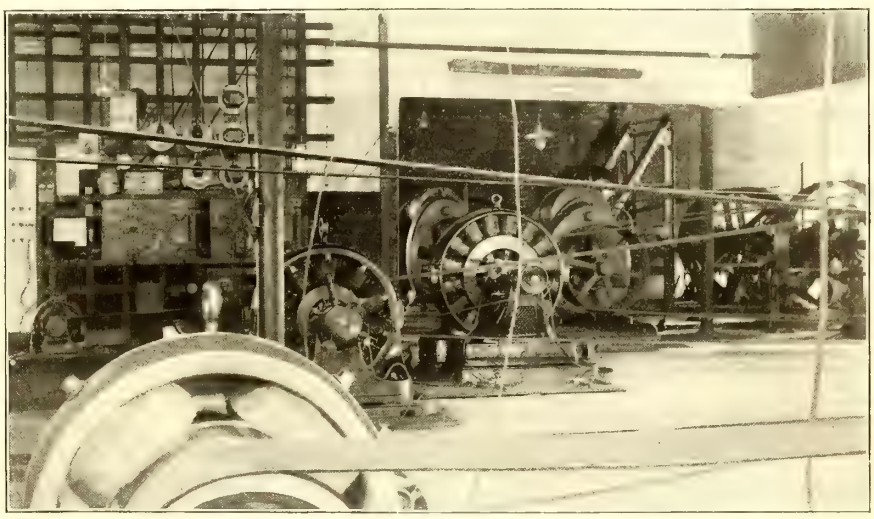
While thus starting out on a new growth in a most substantial way, Fond du Lac has lost none of its prestige as a summer resort. Situated at the head of beautiful Lake Winnebago, it is in itself an ideal summering point for all who love water, woods and parks, while all along the east shore of the lake are clusters of cottages, besides the more pretentious resorts of Lakewood, Taycheedah and Winnebago Park. All of these it is expected will, at no distant day, be connected by an electric railway line, which, in connection with the city lines, park lines and the North Fond du Lac line, will constitute a system of considerable proportions.

The Fond du Lac Street Railway & Light Company was organized April 1, 1899, at which time it consolidated with the Fond du Lac Electric Company. This latter company had just received a fifty years' franchise from the city of Fond du Lac for electric railway and for electric and gas lighting, and also controlled the entire electric lighting system of the city. The new company immediately commenced the construction of a street railway system extending from Lakeside Park on the north to Athletic Park on the south, traversing the entire city, the line being opened for traffic June 27, 1899. In December 1899, construction was commenced on the extension of the line to North Fond du Lac, the new home of the Wisconsin Central car shops. This road was opened for traffic Jan. 21, 1900, the entire line having been built during the months of December and January, a rather unusual achievement in that climate of severe winters. In this instance, however, there were few interruptions on account of weather, or for any other cause, and exceptional rapidity of construction was made possible.

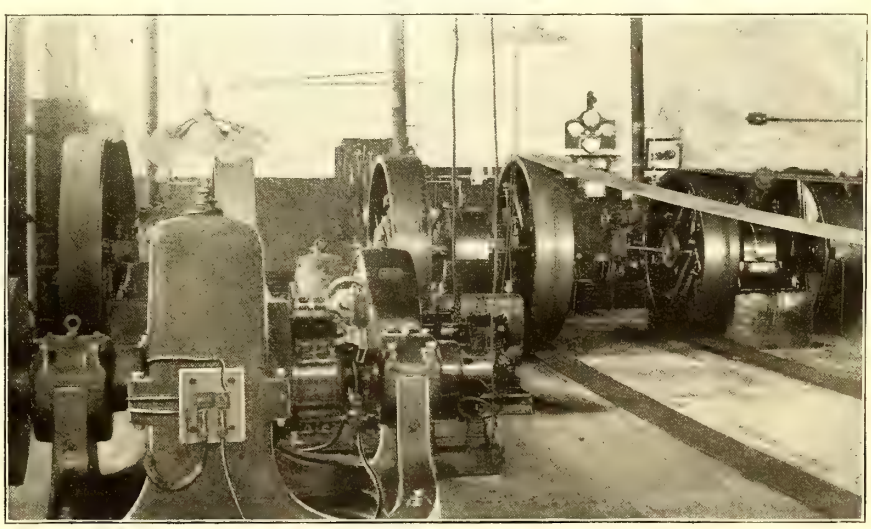
The power station is of brick, and is situated on West Rees Street, near Main Street, and along the tracks of the Chicago & Northwestern Railroad and the Chicago, Milwaukee & St. Paul Railroad, almost in the center of the city. Its general dimensions are 100 ft. x 150 ft. It is not only a power house for the street railway, but from it is furnished the current for private and city lighting and power, which consists of 190 2000-cp arc lights and 8500 incandescent lamps, as well as about 150 hp in small motors.

There are at present four 16-ft. x 6-ft. return tubular boilers and one Aultman & Taylor horizontal type water tube boiler with 3000 sq. ft. of heating surface. The latter boiler has recently been installed, and is so located that all future boilers to be added to the plant will be of the same type.

The engines, which are all compound condensing, consist of three 9in. x 13-in. x 12-in. Ball tandem-compound, which were originally installed for the lighting system; one 16-in. x 30-in. x 36-in. tandem-compound Corliss engine, manufactured by the E. P. Allis Company, of Milwaukee, belted to a 6-in. Hill self-oiling countershaft, and a 16-in. x 30-in. x 36-in. cross-compound Corliss engine manufactured by the Allis Company, direct belted to a 250-kw, three-bearing Westinghouse railway generator, and a 75-kw, 500-volt Western Electric power generator. The condensing apparatus consists of one 500-hp jet condenser, manufactured by the Buffalo Steam Pump Company, installed with the original lighting plant, and one 600-hp jet condenser, manufactured by the Dean Steam Pump Company, of Holyoke, and recently added.



SWITCHBOARD AND LIGHTING GENERATORS



RAILWAY GENERATORS

Including the machines mentioned above, the electrical equipment consists of one 250-kw generator, one 100-kw generator, and one 75-kw generator, all of 550 volts; two 125-light Western Electric, latest type, bipolar are dynamos; three alternators and one 50-kw, 500-volt motor,

which operates a 50-kw alternator for day lighting. By this latter arrangement the entire day load is carried by the cross-compound Corliss engine, the motor receiving its power, as well as all other small motors in the city, from the power generator, which is operated independently of the railway generator, and is a metallic circuit. It is usually

WAITING STATION AT PARK TERMINUS

supposed that operating lighting machines from railway engines will show considerable fluctuation, but in this instance, the engine being of the cross-compound type and having a very heavy fly-wheel, the regulation is very close. The motor which drives the alternator is a shunt-wound machine, and is operated with a weak field, the change in voltage on the lighting circuit never being more than 2 per cent, with a variation from no load to full load on the engine.

This equipment is entirely new, the engines, generators and motors having only been started within the past few months, and has proven a valuable and economical addition to the plant. It should be borne in mind that the present power house has been added to the equipment of what was formerly the Fond du Lac Electric Company's lighting plant, it being necessary to keep the lighting plant in continual operation during the extension. Both the lighting plant and the railway plant are kept in operation during the entire twenty-four hours, making it necessary to install new machinery, piping, etc., without shutting down. The steam piping has been entirely rearranged with all high-pressure pipe and fittings, and Crane extra-heavy valve guaranteed for a pressure of 250 lbs. to the square inch. The average steam pressure carried is about 140 lbs. per sq. in.

The overhead construction is principally side-pole construction. The poles are of cedar, and are 30 ft. long with 8-in. top, the first 8 ft. above ground being painted black and the rest white. No. 00 trolley wire is used throughout the entire system, double wire being used from the power station to the junction of the North Fond du Lac and Lakeside Park lines at Scott Street, thus dispensing with feeder wires and overhead switches. All bells, ears, etc., were manufactured by the Ohio Brass Company.

Both double and single track are used. Within the city proper the streets are paved with cedar blocks. Here 80-lb., 7-in. girder rail is used in 30-ft. and 60-ft. lengths. The line to North Fond du Lac and to Lakeside Park is 60-lb., 30-ft. T-rail. All bonding is with No. 0000 Atkinson bonds. Cedar ties, laid on 2-ft. centers, are used throughout the entire system.

The road is practically level, the steepest grade not being more than 1 per cent. During the summer months the traffic is exceedingly heavy, considering the population of the city, cars being operated with trailers during certain hours on six-minute headway. The drop in voltage on the line at the extreme terminus, which is about 5 miles from the station, is about 50 volts. At the present time the company operates nine closed, full-vestibuled motor cars, manufactured by the American Car Company, of St. Louis, with rattan cross reversible seats. Seven of these are equipped with Peckham 7-B trucks and Westinghouse 12-A 30-hp double-motor equipment, with K-10 controllers, while two are equipped with the American Car Company's maximum traction, double trucks and 38-A 50-hp Westinghouse double equipment, with K-11 controllers. There are also operated four 10-bench, reversible seat, open cars equipped with Edison No. 6 motors, three closed trailers with side seats, and two open trailers with ten reversible benches. The latter cars were manufactured by the Stephenson Car Company.

STANDARD OPEN AND CLOSED CARS

The company proposes to erect extensive car houses and repair shops, as well as a new office building in the near future. This new building will be located at the corner of Main and Rees Streets, adjacent to the power house, and will occupy a space 110 ft. x 170 ft. Many important extensions have also been planned for the future.

The line at present passes through the business district of the city, reaching all the principal hotels and business houses, as well as Athletic Park and Ingram's Grove on

the south, Lakeside Park on the north, and Central Park and the Wisconsin Central car shops at North Fond du Lac. Band concerts are held at Lakeside Park weekly, and sometimes oftener. Besides this, other forms of entertainment are provided at this delightful park, and at such times the patronage is so large that the street railway is taxed to its utmost capacity. The line to North Fond du Lac is exceedingly well patronized at all times, cars being operated all night on this line in order to accommodate train crews, etc. On mornings and evenings it is necessary to use trailer cars, while trailers and extra motor cars are also pressed into service on Sundays and holidays.

The officers of the company are: T. F. Grover, president, under whose direct management the system was planned and built; William E. Cole, secretary and treasurer; F. M. Bingham, chief engineer at power station.

Demerara Electric Company, Ltd., of British Guiana

This month has seen the completion of the first standard, up-to-date trolley road and electric plant in northern South America. Montreal capitalists have undertaken it.

The city of Georgetown and suburbs has a population of about 75,000, consisting of English, Dutch, French, Spanish, Portugese, East Indians, etc. It is well laid out, with broad streets and avenues at right angles, many being 80 ft. and 120 ft. wide, with fresh water canals in the center.

This Canadian company was formed with Sir William Van Horne as president, and bought the existing electric plant and mule tramway with their rights. The old track, although only down two or three years, was taken up, and 11 miles of 62-lb. rails were laid on steel ties, with tie-rods —the whole being imbedded in solid concrete stringers, 20 ins. x 10 ins. The poles are of steel, and no wood is used either above or below ground. This makes a track of great strength and rigidity, besides being very smooth running, and with great wearing power, as the entire rail and joints are equally supported on concrete.

The company has a contract for city lighting, and a large number of lamps are in circuit for private houses and stores. The company has a capital of $850,000, with $500,000 5 per cent bonds.

The franchise, like that of the West Indian Electric Company, Ltd., of Jamaica, is for thirty years, but subject to renewal every twenty years, unless the government buys the company out. Thus there is always an alternative. Fourteen eight-bench open cars will run all the year round, as Demerara is close to the Equator, with a daily temperature of 85 deg. to 90 deg. for the twelve months. The power station has seven engines, of about 1300 hp, with B. & W. and Stirling boilers.

An Electric Railway in Corea

The Seoul Electric Railroad is the only electric road in Corea, and was the first railway of any sort to be built there. It extends from the Queen's Tomb, east of the city of Seoul, through the center of the city, and beyond the southern wall to the Han River. The main line runs through the east and south gates, while a branch line runs through the west gate, and nearly surrounds the terminal of the Seoul and Chemulpo steam railroad, which is located just outside the city walls on the southwest. The total length of the road is 10 miles, 5 miles of which are inside the city walls and 5 miles outside. An extension from the Queen's Tomb eastward to Toksoh, a great distributing center, 6 miles away, on the Han River, is now being constructed.

The roadbed is comparatively level. The heaviest grade is one of 5½ per cent, half a mile long, near the west gate. Besides this there are one or two small hills. The gage is 3 ft. 4 ins. There are some pretty sharp curves, two or three on a 60-ft. radius, being made necessary by the peculiar defensive work in front of the city gates. One of these curves, near the east gate, is shown in the illustration. The cars are 28 ft. long, single truck, combination, open at both ends, after the manner of California cars. The power house is located just inside the east gate. The equipment consists of five units of 230 kw, and one of 175 kw. These are double-current machines, supplying both direct and alternating current, the latter being used for lighting the city and palace at night.

The road is owned by the Corean government, but was built, and is still operated, by Collbrand & Bostwick. The road carries about 110,000 people per month, out of a total

ELECTRIC CAR AT SEOUL

population of about 400,000. Besides the passenger traffic the road handles a large quantity of freight from the river and the railroad terminal. The road is divided into six sections, and the fare is 5 sen, or 2½ cents, on each section, making 15 cents for the whole line. The motormen and conductors, which were at first Japanese, are now entirely Coreans. The employees at the power house, car houses, etc., are Americans, supplied by the Market Street Railway Company, of San Francisco. The cars are run at the rate of 9 miles an hour inside the city wall, and 17 miles an hour outside the walls, and are operated from 6 a. m. until midnight.

The prejudice of the people against the road, which was very strong at first on account of a superstitious belief that the power house was the cause of a dry season, has now almost entirely disappeared. Only one serious disturbance has occurred. At that time two of the cars were burned and several demolished by the mob, partly because of the above mentioned superstition and partly on account of the accidental killing of a boy by one of the cars.

The South Orange & Maplewood Traction Company, of Orange Valley, N. J., has decided to enter the freight business, and it will be first electric railway company in New Jersey to make this a feature of its business. The line extends from Orange to South Orange, chiefly over a private right of way, and connects at Main Street, Orange, with the Orange branch of the Greenwood Lake Railway, which is owned by the Erie Railroad. The company will construct sidings in the different towns through which it runs, and will haul freight and coal cars direct to their destination.

PROCEEDINGS OF THE INTERNATIONAL STREET RAILWAY CONGRESS

(From Our Own Correspondent.)

The official programme of the International Street Railway Congress, held in Paris in connection with the Paris Exposition, was published in the STREET RAILWAY JOURNAL for April, and abstracts of the papers presented have been published in subsequent issues, most of them in November. The date of the meetings was Sept. 10 to 13, and the sessions were held in the "Hall of Congresses," located on the Champs de Mars, Paris. The "Congress" was organized under the auspices of the International Street Railway Association, which comprises most of the important street railway companies on the continent of Europe, and which holds regular biennial meetings in various cities in Europe. The last convention of this association was held in Geneva in 1898.* At the time of the Geneva meeting it was decided to hold the 1900 convention at Paris during the time of the Universal Exposition, and make the session an International Tramway Congress.

A committee of organization was appointed as published in these columns during September of this year. Pierre Baudin, Master of Public Works in France, accepted the position of Honorary President of the Congress. The different governments of Europe and that of the United States appointed delegates, selected for the most part from prominent representatives of the industry. Those from the United States were Col. Truesdell, of Washington; Prof. Wilkins, assistant in the Department of Transportation in the Paris Exposition, and W. Allen, secretary of the Massachusetts Railroad Commission.

The number of persons attending the Congress was about 500. Throughout the work of the organization was excellent, and great interest was taken in the questions treated. Much of the credit for this is due Messrs. Géron, of Cologne, and Nonnenberg, of Brussels, the latter secretary of the association, who had charge of the very difficult work of translating alternately into German and into French all of the reports and discussions. The papers and reports themselves were published in both languages, as were also the extended appendices which accompanied all of the papers. The delegates themselves, in speaking and in discussing the questions, used the language with which they were most familiar.

Through the courtesy of Mr. Fuster, general secretary of the French Street Railway Association, and who also acted as chairman of the executive committee, and in this capacity had charge of the social end of the convention, this portion was very successful. The excursions were undoubtedly the most interesting of any which were held during the different congresses at the Universal Exposition, and all the attendants took back an excellent remembrance, not only of the social side of the convention, but also of the technical questions which were discussed.

On Sunday, Sept. 9, an informal reception was given at the Continental Hotel, for the purpose of making the delegates acquainted with each other. An attractive lunch was served and music was discoursed during the reception.

On Monday morning the Congress held its first session, and the delegates were called to order by the representative of the Minister of Public Works, Mr. Pérouse, Councillor of State and Director of Railways. In a charming address Mr. Pérouse welcomed the delegates in the name of the French government. He referred to the great mission which the street railways were carrying out, and especially those operated by mechanical traction. Public officials, he stated, took a great interest in this industry, and the proceedings of the Congress would be followed with great attention. The government would appreciate especially any study which might be given by the Congress to questions relative to tramway legislation. Most of the existing statutes on this subject were based on antiquated methods of operation, and many of them were not applicable to those of the present day. This was particularly true in regard to interurban and long-distance lines, which had come undoubtedly to remain. The French law of June 11, 1880, for instance, made no difference between the city and the interurban railway, in which the methods of operation are now so dissimilar. Mr. Pérouse thought that sessions of the International Street Railway Association, in the future, would undoubtedly have to be held annually.

HALL OF CONGRESSES, IN WHICH THE STREET RAILWAY CONVENTION WAS HELD

After this address Mr. Pérouse resigned the chair in favor of Mr. Janssen, chairman of the committee on organization, after which the list of chairmen for the association was announced. It comprised the following:

For chairman of the association on Monday, Mr. Aigoin; for chairman of the association on Tuesday, Mr. Lavalard; for chairman of the association on Wednesday, Mr. Lévy. The association was presided over on Thursday by Mr. Janssen himself.

The business of the association was then immediately commenced. Abstracts of the papers and reports presented to the association have already been published, and the discussions to which these gave rise are given later in this article.

On the afternoon of Monday the delegates visited the power station and the plant of the Metropolitan Under-

*See STREET RAILWAY JOURNAL for December, 1898.

ground Railway of Paris, the exposition at Vincennes, the Bastille—Charenton electric tramway and the electric tramway of the Est Parisien Company, which is equipped with the Diatto system. On Tuesday the City Council of Paris received the delegates in its magnificent rooms in the Hotel de Ville. From here the delegates went by special boats to visit the electrical plant and line of the Orleans Railroad Company. On Wednesday a visit was made to the compressed air power station at Billancourt, and to the Westinghouse electric power station which supplies current to the Ouest Railroad Company and to the cars of the Tramway Company of the Ouest Parisien, and of the left side of the river. A lunch awaited the delegates at the Billancourt power station, and they were shown around this plant. On Thursday the system of the Northern Tramways Company and of the Company of Mechanical Tramways of the Environs of Paris received the delegates, carried them over their lines and took them to St. Germain-en-Laye. The cars were decorated with flowers and presented a tasteful appearance. Upon arriving at St. Germain the delegates were met by the municipal officers, and were tendered a lunch at which high-potential champagne, at great frequency, was served. On Thursday evening a banquet was held, at which nearly the entire number of five hundred delegates were present. It was extended to the delegates by the French Street Railway Association in the large Salle des Fêtes of the Palais d'Orsay at the terminus of the electric railway at the Orleans depot. On Friday an excursion was made to Versailles and the Trianon by means of the compressed air cars of the General Omnibus Company. All of these pleasant meetings and excursions contributed not a little to the charm of the Congress, and the termination on Friday caused general regret to all the delegates. There was a feeling of satisfaction, however, at the thought that a great deal of valuable work was done by the association in the business meetings, and this portion of the proceedings will now be described.

In the meeting on Monday the first paper presented was that by Messrs. Géron and de Pirch. On Tuesday, reports of Messrs. Gunderloch, Thonet, d'Hoop, Van Vloten and Fischer-Dick were given. Wednesday was devoted entirely to the discussion on the report of Messrs. Broca and Johannet on accumulators. On Thursday the four remaining papers were received and discussed.

I. STREET RAILWAY FARES

MR. GERON read his report in French; it was then translated into German. He considered the consequences occasioned by the recent general reductions in tramway fares which had been made in Europe, basing his paper on the replies received to a set of questions which he had sent to the companies of the International Street Railway Association. The conclusions, which he gave at the end of his paper, and which he requested the association to adopt as its sentiments, were as follows:

1. The fares to be charged upon city tramways ought to be simple and low; their actual amount must depend upon local conditions.

2. For large cities it is best, as a general rule, to have a considerable area, covering the greater part of the center of the city, in which a uniform fare is charged, but this fare is not to include transportation on the suburban lines.

3. The general use of transfers (or "correspondence") tickets is to be recommended. There are places, however, where an additional fare should be charged for a transfer. (The word "correspondence" cannot be exactly translated by the English word transfer, as a "correspondence" ticket, under the usual European rule limiting the carrying capacity of cars, can be used for passage only if the second car which the passenger wishes to board is not already filled to its capacity.)

MR. MONMERQUE, operating manager of the General Omnibus Company, of Paris, spoke against the third conclusion. The association, he thought, ought not to accept this, especially when stated in so positive terms. He thought that the expression "transfers are to be recommended" should be modified. This proposition is not true in all cases; in fact, it is a debatable question. In many cases the transfer system has undoubtedly been of great service. It has been the means of popularizing and developing the traffic on omnibuses and tramways in cities

THIRD-RAIL SYSTEM, OUEST RAILROAD CO. EXPOSITION TERMINUS

where it has been adopted, but these conditions are never the same, and there are many drawbacks. In every case where they have been adopted, transfers have also proved a source of great trouble in operation, on account of the supervision and inspection which they entail, not only on the public, but also on the employees. The loss of time to both public and company, which results from their use, is also considerable. In conclusion, M. Monmerqué demanded that the third conclusion ought to be modified before being adopted by the association.

MR. LAVALARD, associate manager of the General Omnibus Company, of Paris, expressed himself as of the same opinion as Mr. Monmerqué. He admitted that the transfer system was serving an excellent purpose. It might have been indispensable, while cars were run exclusively by horses, and each line had to be necessarily of short length. With mechanical traction, however, the companies were giving much longer rides for the same fares, so that there was no longer the same reason for giving transfers. Mr. Lavalard had made a number of trips into foreign countries, and had studied the subject of the use and growth of transfer systems. He remarked that while it was possible to create a system of transfers which would obviate, to a

large extent, any great loss of time, he did not believe that such a system was universally applicable, and particularly that it could not be used in Paris.

Mr. Thonet, general manager of the Liége tramways, also expressed the same opinion as the two preceding speakers. Any transfer system is vulnerable to numerous frauds. Where fares are low it should be possible to dispense with the issuing of transfers. The speaker had also given considerable attention to the subject of trying to devise a system of transfers which would get rid of the most serious objections to the system, but he acknowledged that up to this time he had not been able to find or invent any system which would give satisfaction.

Mr. Grialou, manager of the Lyons tramways, made a particularly interesting contribution to the debate, for he had collected and presented to the Congress various figures and results derived in actual practice by the Société des Omnibus et Tramways de Lyon, of which he is manager. He stated that his annual receipts, under the fares formerly charged, reached from f.5,500,000 to f.6,000,000 ($1,100,000 to $1,200,000). Then the fares were lowered to f.0.10 (2 cents) for second class and f.0.20 (4 cents) for first class. As a result, the average receipts per passenger carried amounted to only f.0.085 (1.7 cents) on account of the employment of transfers. The loss of receipts which resulted was then from f.500,000 to f.600,000 ($100,000 to $120,000). But this was not all; the frauds practiced on the company were considerable. It was impossible to make sure that the passengers would use their transfer tickets from the transfer point, and that they would use them immediately. It was also impossible to make sure that the conductors themselves did not turn in to the head office transfers instead of cash fares received, or else did not exchange transfers with the conductors of connecting lines, and then turn them in in the evening in the place of cash. To determine how much of this was being done, and to find out a way to stop it, the company employed from 150 to 180 inspectors to check up the transfers and eliminate fraud if possible. As each one of these inspectors was paid annually f.1,800 ($360), the company's expense for this item alone was about f.300,000 ($60,000) per year. The total loss caused to the company by the employment of the transfers was then not far from f.1,000,000 ($200,000) per year. This expense was not justified, for without transferring the public can travel from 10 km to 12 km (6 miles to 8 miles) for 10 centimes (2 cents). Under these conditions the earnings of a company are not satisfactory.

Mr. Köhler, manager of the Grosse Berliner Strassenbahn, expressed the same opinion as the preceding speaker. He did not believe in introducing a general system of transfers. When the fares charged on street railway lines are high, they might, perhaps, be lowered, but when the fares are reduced, as they have been in Europe during the few years, it is impossible to allow passengers to transfer one or two times without paying an additional fare. In Berlin it is possible to travel 20 km for 10 pfennigs (12½ miles for 2½ cents). This fare does not carry with it any transfer privileges. Mr. Köhler demanded that the association should not recommend the employment of transfers.

Mr. Debray, manager of the Ouest-Parisien tramways, remarked that the proceedings of the Congress were read with great interest by the public, and that it would be very undesirable for the Congress to pass a resolution indorsing transfers, for the public would then consider itself justified in opposing any decision adverse to transfers on the part of any tramway company.

Mr. Scheidtweiler, official delegate from the municipality of Cologne, expressed himself in the same way as Mr. Debray, but from the standpoint of a municipal officer. Municipalities do not wish to impose impossible burdens on the companies, but if the association should indorse the third conclusion in Mr. Géron's report, or if they should not express their disapproval of it, it might be very difficult for a street railway company to avoid giving transfers under all conditions.

Mr. Monmerque, in resuming the preceding debate, proposed a change in the third conclusion of the report.

Mr. Janssen suggested that this change should be referred to a special committee, who could study the terms of the resolution, and should submit the result to a vote of the association at its next annual convention.

Mr. Lavalard stated that the importance of the question was too great to allow the thing to be dropped. It was necessary to record some decision on the proposition. In consequence, he proposed that the association adopt the first two conclusions of the report of Mr. Géron, but that it should not take any action on the employment of transfers. This question should be the subject of a special report, which should be the basis of a discussion at the next meeting of the International Street Railway Association, which would be held two years from date. This proposition was unanimously adopted.

II. RESULTS OF THE APPLICATION OF ELECTRICITY TO STREET RAILWAY SERVICE

Mr. de Pirch, manager of the Barmen-Elberfeld Electric Railway, Germany, made a study in his report as to what had been the result of the application of electricity to traction purposes, from the standpoint of increase of traffic, expenses of operation and net profits. He concluded as follows: "The system of electric traction by the overhead system is to be recommended in place of that by steam locomotives, when the operation is one of short trains following each other at short intervals on lines of long distance and heavy traffic. It is especially desirable for existing lines on their own right of way, whenever the length of franchise is sufficiently long, and when impossible conditions or exorbitant burdens are not imposed to reduce or destroy the profits possible from the introduction of electricity."

Mr. Monmerque demanded that the wording of this conclusion and the text of the paper should be modified so as to emphasize the fact that the advantages mentioned from the use of electrical traction applied only to electrical traction by overhead wires. He stated that railway managers did not have yet enough experience with other systems, such as the conduit and the surface-contact system, to allow them to recommend such systems.

Mr. de Pirch was of the same opinion as Mr. Monmerqué, and proposed the same changes as demanded by the latter. The conclusions given in the report were true only when the trolley system is used.

Mr. Köhler, of Berlin, agreed with the conclusion in the report of Mr. de Pirch. The latter had expressly stated that the system recommended was the trolley system. As, however, there had been some doubt in the minds of some of the delegates, which doubt was, to a certain extent, justified, Mr. Köhler proposed that the conclusion of Mr. de Pirch be adopted, but that it should be distinctly specified that the reference to the electric traction referred entirely to the trolley system. This proposition was unanimously adopted.

III. ADVANTAGES AND DISADVANTAGES OF STANDARD AND NARROW-GAGE TRACKS FOR ELECTRIC RAILWAYS

The speaker, Mr. Gunderloch, not having been able to be present at the meeting, his paper was read by Mr.

Géron. Mr. Gunderloch in his report considered the question from the standpoints of the possibility of mounting the electrical apparatus on the truck, and of the exchange of rolling stock and equipment with trunk lines so as to avoid the reloading of freight. He concluded by saying that standard gage should be adopted in every case as far as possible, and that narrow-gage tracks should not be laid except where the standard gage was practically out of the question.

MR. JANSSEN asked Mr. de Burlet, manager of the Société Nationale des Chemins de Fer Vicinaux, of Belgium, the reasons which had led that company to adopt the narrow gage, almost exclusively, on its very extensive system.

MR. DE BURLET, in reply, stated that he thought a greater distinction should be made than was done in the report between city lines, suburban lines, and steam trunk railroad conditions. For the first class of these roads, *i. e*, the city lines, the conclusions as given in the report are justified, but for the second he wished to dissent from the rules laid down by the writer of the paper. The gage of such lines should be narrow. Thus in Belgium there are more than 100 interurban lines in operation. The total length is about 2500 km (1500 miles). All are narrow gage with the exception of three. The only reason which led to the adoption of the narrow gage was that of economy in first cost. In many places it is only possible to build these interurban roads by reducing the first cost, for the reason that the standard trunk lines have ramified their branches to such an extent that they already cover the best territory. As a consequence, the interurban light railways must be built cheaply or they will not be profitable; and it is absolutely necessary to make the first cost as low as possible. The capital invested in all of these narrow-gage lines in Belgium averages only about f.47,000 per km ($1,500 per mile); while that invested in standard-gage roads is as much as f.100,000 per km ($32,000 per mile). These figures are enough to justify the almost exclusive employment of narrow gage for this class of road. If in the first place the company had decided to use standard gage exclusively, the return on the capital invested would not have been adequate, and it is certain that there would not have been any such remarkable development in the light railways of Belgium if this had been the case. It is true that, under certain conditions, the receipts exceed the figure at which a change to standard gage is justified. In Belgium, however, this case has occurred in only one instance. The company had built one narrow-gage line in a region which, according to all appearances, would furnish only a small business. Since the construction of the line, however, some important quarries had been developed in the region, consequently there had been an immediate development of traffic, and the company was planning to replace the narrow gage with a standard-gage track, in order to avoid the reloading of freight. But it ought to be understood that when the line was built there was no suspicion of the richness of the country. If the line had not been constructed it is very probable that the first quarry would never have been worked, and the others would never have been discovered. It was the railway which had created the mining business. In the convention held at Amsterdam in 1890 a resolution was passed by the association stating that the narrow gage was the best to employ for light railways, and that the standard gage should only be adopted in special cases. Mr. de Burlet asked whether the association intended to reverse its former ruling on this subject.

MR. KESSELS, general manager of the Société des Chemins de Fer Economiques, of Brussels, differed entirely from Mr. de Burlet on the subject. He argued that the cost of reloading freight in passing from a narrow to a standard-gage road is very small, and does not usually justify the additional capital required to build a standard-gage track. Thus his company, which is an Italian corporation, received only f.0.20 per ton for all the expenses involved in the reloading of freight, including switching, labor, etc. This price, though low, covered all expenses. The company's terminal stations, it is true, are designed to facilitate this reloading of freight, which consists principally of coal and granite.

MR. HASELMANN, manager of the tramways in Aix-la-Chapelle, differed also from the conclusion as expressed in the paper. He thought that, instead of endeavoring to ally themselves with the trunk lines, the light railways ought to endeavor to make a separate system and serve those regions where the standard-gage roads cannot go, on account of their high cost of construction.

MR. TRAUTWEILER, chief engineer of the Strassburg tramways, took the opposite position, defending the conclusions of the reader of the paper. He observed that the paper presented had treated the question as applied to the operation of electric lines, whereas it had been discussed principally in its relation to steam railroad operation. He thought that, when the electric system was employed, the investment was very little different whether a standard or a narrow-gage track was used. The conclusions adopted by the Congress at Amsterdam, he thought, were justified by the conditions presented at that time. Those given in the paper by Mr. Gunderloch, he thought, were justified when the use of electric traction was considered. The association ought certainly to adopt them.

MR. KÖHLER, of Berlin, said he thought that the members had wandered somewhat from the subject of the paper. It seemed as if some of the delegates had confused the needs of tramways with those of light railways. Electric traction would not be adopted on lines of great length for the reason that the first cost of installation was too high.

MR. LAVALARD, who was in the chair, inquired whether it was the sentiment of the association to adopt any conclusions in the absence of the author of the paper. Under these circumstances he thought that the discussion should be continued later, and another subject taken up. This proposition was adopted.

IV. THE EQUIPMENT OF A CENTRAL POWER STATION

This report was presented by two gentlemen—Messrs. Thónet, of Liége, and d'Hoop, chief engineer of the Brussels Tramways, the latter having treated specially the auxiliary apparatus.

MR. THONET regretted that the companies to whom a list of questions had been sent out had not replied to the greater part of them, and especially that they had not given more figures in detail relating to the cost of operation. There were no longer, he said, any secrets to conceal in the manufacture of engines and electric apparatus. All the machinery which enters into an electric railway power station is well known to every one. That which it is desirable to know, however, is how each collection of machinery operates under different local conditions. This information, far from being opposed to the interests of the manufacturers, should be of the greatest value to them in drawing the attention of engineers and of railway managers to the possibilities of economy which could be secured by certain arrangements. The speaker asked whether this question of cost of operation could not be made the order of the day for the next session of the International Street Railway Association. He asked especially for detailed infor-

mation on the employment of storage batteries as station auxiliaries, on their efficiency, life and the cost of maintenance; also on the advantages and disadvantages of triple-expansion engines, and on the cost of maintenance of the different types of boilers.

Mr. d'Hoop then spoke on the portion of the report relating to the auxiliary appliances. He gave some interesting information on the cleaning of cotton waste filled with oil. This cleaning resulted, in Brussels, in the saving of f.15 per day.

Mr. Baumgardt arose to oppose the statement of the readers of the paper that storage batteries when used to equalize the load on power stations were useful only when used in power stations of moderate sizes. He believed that they gave excellent satisfaction when used in connection with the largest stations. In support of this he stated that many important companies in the United States were using batteries in this way.

Mr. Monmerque, who was prevented from attending the session, asked through a letter addressed to the president that the first conclusion in the report should be modified. Triple-expansion engines are now employed in many installations. The conclusion in the report referred to should then be modified to read: "In very large installations compound or *triple-expansion* engines should be direct coupled to the generators."

Mr. Thonet supported the suggestion of Mr. Monmerqué, but did not think that the report presented should be changed so far as the reference to the employment of accumulators was concerned. The association did not possess sufficient information on the subject of the use of storage batteries as station auxiliaries in large power plants to justify the alteration suggested. The members could hardly then commit themselves on this important subject. If the resolution was passed many station engineers would believe they could adopt batteries for this purpose. It did not seem advisable absolutely to recommend them for large systems, because in the latter the fluctuations in the current are relatively small on account of the large number of cars in service.

As a result of this discussion the conclusions contained in the report, but modified in the way indicated by Mr. Monmerqué, were adopted.

V. SYSTEMS OF POWER DISTRIBUTION FOR ELECTRIC RAILWAYS

Mr. Van Vloten being absent, his report was presented to the Congress by Mr. Pedriali, electrical engineer of the Brussels Tramways. The object of the report was to point out the advantages and disadvantages of each of the principal methods of power distribution for electric railways, and indicate under which conditions, speaking broadly, each system could be adopted most advantageously.

Mr. Monmerque, who was also absent, sent a written communication to the president, making the following requests: First, that the third paragraph of the conclusions should not be adopted, as accumulators ought not to be considered as a method of distribution; second, that in the fifth paragraph it should be distinctly stated that the reference applied exclusively to distribution by three-phase currents and not by polyphase currents in general.

Mr. Debray demanded that the association should not indorse any of the conclusions, and that it should extend its thanks to Mr. Van Vloten for his very remarkable and very complete report. The subject which it treated was not one which permitted an absolute answer. The question of power distribution requires a special investigation in each case, and as no concrete examples were given, no certain conclusions were possible. Mr. Debray insisted that in the future the questions proposed should be more precise in their character.

Mr. Thonet expressed himself as being of the same opinion as Mr. Debray, but he thought that the association should indorse the conclusions of the report, these conclusions being really that the general rules suggested in the paper ought to be applied with discretion in favor or against each system mentioned.

Mr. Janssen thanked Mr. Debray for the suggestions which he had given on the subject, of the necessity of formulating exact questions. This suggestion would be followed in the future. He thought also that the association need not take a vote on the conclusions on so general a subject, and proposed that the association should send a vote of thanks to Mr. Van Vloten for his valuable and conscientious paper. This motion was passed unanimously.

VI. THE FALK JOINT

The paper by Mr. Fischer-Dick, associate manager of the Grosse Berliner Strassenbahn, was a most favorable indorsement of the Falk joint. This opinion had all the more weight from the fact that the writer has devoted a large part of his time recently to a study of the joint question on tramways, and has himself invented a number of joints, which have been widely adopted in Germany. The paper brought out the fact that the first cost of a street railway track joint is not of very great importance, provided the more expensive joints add considerably to the life of the rails, on account of the high cost of the latter, which in Berlin is as high as f.220,000 per km of double track, when laid in an asphalt street.

Mr. Thonet stated that it had not been the custom to use rail bonds in connection with the Falk joint, as the joint itself gave sufficient electrical contact between the ends of the rails. Bonds were considered by some necessary at first, but general practice now is to omit them. He suggested that the Congress thank Mr. Fischer-Dick and accept his conclusions.

Mr. Grialou stated that the Falk joint had been first adopted in France on the system of the Lyons Tramways, and that there the rails had been bonded on the first line which was cast welded, but that this precaution had proved unnecessary. The only breaks which occurred were produced in the winter, and were extremely rare. The measurements of track resistance, which should be made periodically, would soon determine these breaks, and they could be repaired.

The conclusions given in the report by Mr. Fischer-Dick were adopted.

VII. TRACTION BY ACCUMULATORS

The report of Messrs. Broca, manager of the Tramway Company, of Paris, and of the Department of the Seine, and Johannet, engineer of the General Traction & Electric Company, of Paris, which immediately followed that by Mr. Fischer-Dick, provoked a very long and most valuable discussion. The writers of the paper, without declaring themselves partisans of the accumulator system of electric traction, thought that it ought not to be condemned offhand. The certain advantages which it did possess should receive recognition, and they suggested to the association that it should indorse the following conclusions, which differed from those presented in the report, and which read at follows: "The International Tramway Congress, after having read the report of Messrs. Broca and Johannet, decides that traction by accumulators is much more expensive than traction by overhead wires, and ought not to be considered except under exceptional conditions. In fact,

the overhead system is the only one which insures reliability of reducing fares, and the only one which will give satisfaction to the real needs of the public.

MR. JANSSEN rehearsed the fact that from 1892 to 1898 experiments were made continually at Brussels with storage battery cars. The results of these experiments were most unfortunate, and storage battery traction was abandoned as a result. At the convention at Geneva a request was made for a report on the "improvements made" in storage battery cars. As a consequence, the report was written, but it showed that there had been no improvements. Municipal authorities generally seem to think that it is only the high cost of this method of operation which keeps the companies from adopting storage battery cars. The speaker thought, then, it was very important for the association to go on record as stating that this was not the principal reason. Certain companies had adopted systems of electrical traction which were certainly as expensive as accumulators. The real reason why storage battery cars could not be used on city streets was that they could not be depended upon to give the regularity in service which the public had a right to demand.

MR. BOULVIN, of Ghent, declared himself absolutely opposed to accumulator traction, and based this opinion on the experience which he has acquired, especially in Ghent. He thought that all railway managers who have had anything to do with storage batteries would agree with him in this opinion. For more than ten years his company had been trying to make storage battery cars work. The only result of this extended trial had been absolute failure, and theoretically it could not be otherwise. One of the principal reasons is because the chemical reactions to which an accumulator plate is subjected require a certain surface depending on the size of the current. If this surface is insufficient, disastrous results follow, which, moreover, last through the life of the accumulator and become aggravated when an excessive demand is put upon them even for an instant. The surface of the plates should then be so large as to support this discharge rate, and should be as large as in stationary batteries. This plate area, for example, should be large enough to admit a discharge rate of the maximum current required while the car is going up the steepest grade when the track is covered with snow. These being the conditions, it is very easy to see that the employment of accumulators on cars is impossible by reason of the weight and size at which the cells would have to be made. A battery designed for the average rate of discharge, even for the average maximum rate, would not withstand the peak of the maximum discharge, which would often be called for on a trip.

In the installation which he had made, Mr. Boulvin had found that the consumption of coal per car kilometer with storage batteries was double that which it would have been with the trolley. Mr. Boulvin then considered the report of Messrs. Broca and Johannet. The conditions announced, he thought, were sometimes justified from a theoretical standpoint, but they were not always possible. Thus, centralization is possible with a single line or with a system of lines which crosses at some point, but on most tramway systems this is out of the question. It is certainly a good thing for a company to make its own plates, but this involves a large force of employees and many processes. It is not only necessary to cast the lead, but the company must treat it with sulphuric acid, make the cells, etc., and a tramway manager has his own troubles without embarking in such outside work. A slow rate of charging is certainly preferable to a rapid charge, but there are often many practical difficulties in charging batteries slowly, and, again, there is trouble in providing sufficient room in the cars to accommodate both the passengers and the batteries. Again, the arrangement of the car houses and termini depend largely upon local conditions, and cannot be placed exactly as the best theory would dictate. Mr. Boulvin expressed himself especially against the favorite claims made for storage battery cars of independent operation. He considered these claims illusionary. "With accumulators," he said, "there is so little independence that the cars cannot run to satisfy either the public or the company, but exclusively for the satisfaction of Mr. Accumulator." The great aim in operating tramways is to obtain flexibility to car service, and to proportion the number of cars to accommodate the traffic. This is absolutely impossible when storage battery cars are used. They are certainly not adapted to the service of large systems, and if they can be employed to advantage at all, it is only in very rare and peculiar cases.

MR. MICKE, director of the Grosse Berliner Strassenbahn, stated that the mixed system of storage batteries and accumulators had been employed in his city. The company had not wanted to use it, but it had been forced upon them by the municipal authorities. The section operated by accumulators included 20 km of double track, and formed a considerable part of the entire system. It was early recognized that even if it was possible to regulate the discharge from the battery so as to give long life to the plates, it was impossible to regulate the charging rate in the same way, as the batteries were charged while they were running in the sections equipped with the trolley. The storage batteries gave very unsatisfactory service, especially during winter, when the rails were covered with snow and ice. At this time the demands for current on the overhead sections were so great that the accumulators were charged under most adverse conditions. If the cars had been kept at the end of the overhead system until the batteries had become sufficiently charged before starting on the battery sections, at least sixty-four cars would have been held at one point on the system; at other points there would have also been blocks of cars almost as large. Briefly, during the winter and while the snow lasted, the cars frequently had to stop running, and the service was so poor that the municipal authorities finally authorized the employment of trolley wire temporarily on the storage battery sections. The company then took up the subject very carefully with the municipal authorities, pointing out the objections to this method of traction exclusively from the standpoint of the public, and asked authority to adopt the overhead system, except at certain points where it agreed to install the underground conduit. Mr. Micke added that the storage batteries should be absolutely condemned, except for extremely rare conditions.

MR. KRÜGER, manager of the Hanover Tramways, then undertook a defense of accumulators. He thought, in the first place, that Mr. Micke's conditions had been unfortunate, and he had become prejudiced against accumulators and wished to get rid of them. The trolley system, he added, still produced in the minds of certain people the effect of a red rag on a bull. However, storage batteries ought not to be absolutely condemned. He referred to the results obtained in Hanover, and given in detail in the paper which he had presented to the association at Geneva. The manufacture of plates by the tramway company itself had given good results, for the cost of production amounted to only 2 pf. more per kilogram than the cost of the lead itself. The cost of maintenance amounted to only 0.5 pf. per car km. on the total length of track equipped with trolley and accumulators (the mixed system), and to only 1.02 pf. per car kilometer, considering the length of the section operated by accumulators only.

Mr. Röhl, manager of the Hamburg Tramways, differed from the opinions expressed by Mr. Krüger. The figures which he cited seemed to be contrary to those which had been obtained by the company of which he was the manager in Hamburg. In fact, his own figures showed a cost of current in pfennigs double that which resulted from the operation in Hanover. Moreover, the Hanover Company made its own current under very economical conditions, while in Hamburg the company bought its current from another company and paid quite a high price for it.

Mr. Krüger explained that the figures which he had given applied only to the maintenance of batteries. The cost of current should be figured by itself. This cost per kilowatt in Hanover varies from 6.5 pf. to 4.8 pf., and the transportation of the accumulators on the cars consumed about 50 watt-hours per ton-kilometer. Finally, account also ought to be taken of a loss of about 30 per cent in the accumulators themselves. Mr. Krüger, however, stated that he did not wish to appear as an advocate of accumulators, for he would be very glad to be able to dispense with them on his own system.

Mr. d'Hoop then discussed the question from the standpoint of ease of operation, which, he stated, is the most important point of view. To give the best satisfaction to the public and to carry all the passengers who want to ride, every manager recognizes that on certain days and at certain hours it is necessary to double or quadruple the number of cars. This is impossible where accumulator cars are used, and consequently they cannot give a satisfactory service from the standpoint of the public. Much stress is often laid, he said, on the inconvenience of storage battery cars, but experience has shown that they are much more productive of accidents than are trolley cars. Mr. Van Vloten laid down as a general rule that accidents on storage battery roads varied almost directly with the number of cars, while with a trolley road they vary with the length of the line. They increase very rapidly on the storage battery line with the number of cars used, while with the trolley system they remain almost constant with an increase of cars.

Mr. Köhler, of Berlin, excited considerable laughter in saying that the sympathies of Mr. Krüger had evidently been touched by the condemnations directed against accumulators, but that the latter, through their misdeeds, had merited the most severe condemnation in Berlin, where 400 accumulator cars had been in use. The results had been deplorable, but Mr. Micke had not told everything about them. There the cost of maintenance had reached ten times the figures given by Mr. Krüger. This maintenance cost was defrayed in part by the tramway company and in part by the company which had sold the accumulators. The total cost of maintenance was the same in each case. Again, the accumulator companies had tripled their charges. Under these conditions they had lost all.

Mr. Johannet replied in a few words to each of the criticisms directed against the report which he had read. He referred particularly to a paper which had been presented about two years ago before the International Society of Electricians by Mr. Sarcia on accumulator traction in Ghent. The cost of traction, which included all the details, such as, for example, the cotton waste employed for cleaning, was given as not over f.0.20 per car kilometer, that is to say, a figure considerably less than that for trolley service. The statements made by Mr. Boulvin did not accord with this statement. Again, the cars at Ghent had also been tried in Paris. They did not give satisfaction, and this was largely because they had not been well designed. The cars employed in Paris on the St. Denis line had been built especially for the service for which they were intended. Since 1892 they had run 32,000,000 km, and during this time had been under the direction of Mr. Johannet. It was on the experience which he had acquired in connection with this line that he prepared his report. He defended himself strenuously from being an *a priori* partisan for the accumulator. On the contrary, he thought that it was less desirable than the trolley system. The calculation of the cost of the batteries on the basis which had been indicated in the report read was, in general, 100 per cent better than that which had as a basis the average expense per ton-kilometer. He thought that, as stated by Mr. Boulvin, the capacity ought to be calculated so as to be sufficient for the service.

There seemed also to be some misapprehension of the significance of the word "independent" as applied to accumulator cars. Accumulator cars are independent because they run over any track. They are also independent because an accident which happens to one car does not cause the stoppage of the other cars. This condition often occurs in Paris, where a car stops with its passengers and has to be drawn or pushed by a second motor car. With the trolley system, however, an accident to the system of distribution paralyzes the entire service. The conclusion of Mr. Van Vloten, as cited by Mr. d'Hoop, was then not quite fair. If the mixed system had not given good results in Berlin, it was because the system was not suited to the conditions of the service. Mr. Micke himself acknowledged that the length of the system equipped with the trolley was too small, as compared with the length operated by the storage battery cars. It would be unfair, then, to hold the accumulators responsible because they could not perform impossible conditions. Snow is certainly an important obstacle, but why should it be more so in other cities than in Paris? In Paris the snow is removed and the tracks are salted; as a result the service has never been paralyzed. As for the question of first cost, even if that is not a dominating condition in the case of long franchises, there are in Paris certain systems which have an important traffic, and for which the franchises now have only nine years to run, so that whatever investment is made on those lines must be recouped within that time. Again, a tramway manager ought not to be slavishly wedded to electricity. If the trolley system is not permitted and there are grave objections in the mind of the managers to the use of storage battery cars, why employ them? There are other systems not electric. It has been said that the time for experimenting with accumulator cars is past, and that they should be condemned, but this same argument is not applied to the underground conduit system, which is, as yet, in an experimental stage. As for the surface contact system, who can yet say what its service will be?

Mr. Monmerque, in reply, claimed that one branch of the subject had not been touched upon, and he thought that some light was thrown upon it by the preceding discussion. Everyone agrees as to the troubles given by storage batteries, and that the cost of operation is so high that the method is recognized as a disagreeable alternative. But the public knows very little, and cares less, about this. The only thing that can affect the comfort of the public is irregular service. What the manager ought to do is to enlighten the public as to this defect of storage battery traction; in other words, he should take pains to make it clear that adequate service cannot be given by storage battery cars, that they are not adapted to flexibility of operation, that they are more productive of accidents, that their service is accompanied by a disagreeable and noxious odor, and that they unduly block the public traffic on the streets. As it is not always possible to locate a car house and charging station at the end of a line, a company operating stor-

age battery cars has often to use a quick rate of storage and to charge the cars on the streets. On the Cours de Vincennes-Louvre storage battery line in Paris, where a headway of three minutes is used during certain hours, there are often at the terminus at Vincennes from sixteen to eighteen cars being charged on the street. These are the arguments which ought to be impressed upon the public.

So far as the cost of maintenance is concerned, it has been shown that in Paris an accumulator company demanded at first to maintain batteries f.0.10 per car-kilometer, and then insisted upon raising the price to f.0.30 per kilometer. The figures submitted by Mr. Krüger seem, then, impossible. It would be interesting to have tables on the cost of maintenance prepared by the accumulator companies, for they certainly would not put the price too high, but would prefer to maintain the batteries at a loss.

MR. BOULVIN asked leave to correct an error in a name submitted by Mr. Johannet. The communication referred to by Mr. Sarcia before the International Society of Electricians had not been based on accumulator service carried on in Ghent, but on some trials conducted in Ostend. This correction should be made, as otherwise there might be some confusion, since it was stated in the communication that the Ghent tramways had been put in operation after those of Ostend. But the delegates should not take this communication too seriously. As Mr. Johannet had said, the smallest details in cost were given. The only item in the cost of operation which had been omitted was that of the maintenance of the batteries! This single fact was sufficient to condemn the report. Mr. Krüger should certainly be congratulated for the figures which he had obtained, and also because he was the only one who had ever been able to obtain anything like them. But Mr. Boulvin himself, after the experience which he had acquired in Ghent, and after a very long study of the subject in all its details, thought that horse traction was preferable in every way to that by accumulators. A company would certainly be able to give a better service with horse cars and pay higher dividends.

MR. JANSSEN then reviewed the previous discussion and proposed that the Congress should adopt the following conclusions: "The International Tramway Congress believes that traction by accumulators has made no real progress up to the present, and that it ought not to be used except in very extraordinary and unusual conditions, because, first, with it it is impossible to give a satisfactory service to the public, and second, because the cost of operation is extremely high."

MR. GRIALOU thought that the exceptional cases referred to in the resolutions, in which the accumulator traction could be used, ought to be specified. He insisted upon this point, because to establish an exact comparison between two systems the total cost of operation ought to be considered. This cost should include not only the expense of operation, but the general expenses, interest and sinking fund on the capital engaged, so as to determine in each case the net result in its relation to the length of the franchise and the density of the traffic. Under these conditions it will be seen that, from an economical standpoint, accumulators would show up very disadvantageously, as compared with other electric systems, even if the length of franchise was not long. The first consideration in the mind of a street railway manager ought to be how to carry all the people who wish to ride, for if he does this, his receipts will be a maximum, and he will give the best satisfaction to the public.

MR. BERTINI, manager of the Italian Edison Company, stated that two municipalities in Italy, those of Rome and Turin, had insisted on the installation of the mixed accumulator and trolley system. The companies in those cities had shown the authorities the disadvantages of the system, as explained by the preceding speakers, and the city authorities had finally become so impressed with them that they consented to the abolition of accumulators and the adoption of the overhead system over the entire systems in question.

MR. JANSSEN said that it did not seem to him possible to specify those cases in which accumulators could be employed as required by Mr. Grialou. The resolutions, as offered by Mr. Janssen, were put to vote and adopted.

VIII. HEATERS FOR STREET RAILWAY CARS

MR. DE BURLET, manager of the Société Nationale des Chemins de Fer Vicinaux, of Belgium, considered in his report the different methods of heating by direct combustion, by warm air, by hot water, by steam and by electricity. So far as concerns the heating of cars, he thought the Congress ought to adopt the resolutions presented in a report on the same subject to the Congress in 1894. It said that the heating of street railway cars was not to be recommended and that the association was not able to suggest any desirable method. So far as the heating of light steam railway cars is concerned, his investigations did not show any improvements made during the past two years. As a matter of fact, the question of economy is the most important thing for this class of roads, as has already been explained in the discussion on the third question. Under these circumstances, the speaker did not wish to recommend any existing system, and requested that the subject should be continued and taken up at the next convention.

MR. MONMERQUE stated that in Paris the authorities had insisted that the street railway cars be heated, even those cars which are not entirely closed. They had also prescribed certain methods of heating. Under these conditions the cost of heating amounted to about a franc per car-day.

MR. VON LEBER, member of the Council at Vienna, cited a particular case which had come to his notice in Austria. A tramway company had adopted electric heaters, but had abandoned them after a short time. It was found that this method of heating was too expensive. The cars were then run without any heaters, but the company was obliged to replace the electric heaters, because the absence of heat had lowered the receipts to a marked extent. The climate there was very cold, and the inhabitants often used to board the cars simply to get warm—"to get 2 sous' worth of heat"—as Mr. von Leber jocosely expressed it.

MR. BLONDEL, professor at the Schools of Bridges and Highways, Paris, differed from the conclusions of the writer of the paper so far as the heating of tramway cars in his country (France) was concerned. The authorities insisted that the cars should be heated. The best way of doing this was rather an open question, so he thought a further report on the subject was advisable; besides, the public is used to warm cars. What they wish principally is to keep their feet warm. Under these circumstances, the expense ought to be low. On the Chemin de fer Nogentais the rate is only 0.78 francs ($0.156) per car-day. With certain systems of electric heating similar results can be obtained.

MR. DE BURLET indorsed the suggestion of Mr. Blondel, which was adopted.

IX. METHOD OF OPERATING SECONDARY OR LIGHT RAILWAYS

MR. ZIFFER, president of several railways in Austria, read his report on the advantages and disadvantages of the operation of secondary railways, first by the steam railroad trunk lines, of which they are feeders, and second by independent corporations. He reviewed the different methods by which the operating companies lease these lines from

the owning companies, and concluded by saying that "if it is not impossible, it is certainly very difficult, to make the interest of the operating company and the owning company the same; also that it does not seem possible to lay down any definite rules as to whether these lines had best be operated independently, but that each case should be considered in the light of local conditions."

Mr. de Burlet thought that the conclusions of the speaker should be modified. In Belgium, where the secondary or light railway system is of great extent, the owning company has leased the operation of its lines for the most part to other companies, and in every case the interests of this owning company have been conserved by the company which has had the operation of the line in charge. He demanded then the passage of a set of resolutions in which the conclusions drawn by Mr. Ziffer should be modified. Mr. Ziffer recognized the justice of these remarks.

Mr. Scotter, of London, regretted the almost entire absence of English representation at the Congress. This absence should not be construed as a manifestation of lack of interest on the part of his compatriots in the tramway and light railway industry, but it was a fact that up to within the last few years the English statutes had been such that it had been exceedingly difficult to obtain franchises, and this condition had practically paralyzed the electric railway development. During the last three years a new law, much more desirable, had been passed, and the tramways of that country, which for thirty years had never included more than 2000 km of track, had been within the last three years almost doubled in length. This statement was sufficient to show the interest which was being taken in England in this industry. A new law to cover the construction of tramways and light railways is now under consideration, and it will give a great stimulus to the industry. Mr. Scotter stated that in England it had been found advisable to draw an absolute distinction between trunk line railroads and light railways. The first, on account of their important traffic, can pay interest on a much higher initial cost, and employ a much more substantial kind of equipment than the second could even dream of. This second class of road ought to use a narow-gage track. Mr. Scotter terminated in expressing the wish that at the next Congress England would not be represented by six or eight persons only, but by ten times that number.

The conclusions of Mr. Ziffer, as modified by the views expressed by Mr. de Burlet, were adopted unanimously.

X. ADOPTION OF A STANDARD RATING FOR TRAMWAY MOTORS

Mr. d'Hoop read the report on this subject written by Mr. Macloskie, who was prevented from attending the session. The report concluded by recommending that all motors should be designated by three numbers, represented by the letters C, A, B. The first should indicate the output in kilowatts which the motor could furnish continuously for one hour without its temperature being raised more than 75 degs. C. above the surrounding air; the second figure should be the number of milli-amperes necessary to produce a tractive effort of 1 kg at the periphery of wheels 800 mm in diameter; the third should be the voltage in amperes of the "dead current," or the current required to make up for the mechanical and electrical losses in the motor and gearing.

Mr. Janssen stated that the report had been presented with the object only of suggesting that before making a decision the members of the association should discuss the question fully.

Mr. Hospitalier, of Paris, outlined quickly the method which he believed the most desirable for rating electric railway motors. The power of an electric motor is equal to the product of a torque by an angular speed. At starting, the torque is at a maximum and the speed is zero. The power then is also zero. The speed commences immediately to increase while the torque lessens until finally it becomes zero. At this point the counter electromotive force of the motor is equal to the applied electromotive force. During this transition the power of the motor passes through a maximum. To designate an electric motor it is necessary then to know: (1) its maximum power; (2) its maximum torque; (3) the torque corresponding to the maximum power; (4) the maximum angular speed.

Mr. d'Hoop asked if the manufacturers of electric motors had been asked to express their opinions on the subject.

Mr. Grialou supported the suggestion of Mr. d'Hoop, and insisted on certain conditions to which consideration should be given in treating the subject, viz.: that tramway motors are subjected in city service to very severe conditions. At the time of starting they take very heavy currents. Then when electric brakes are used they furnish for each stop a very heavy current. At Lyons, for example, on one line stops are made every 100 m to 150 m (300 ft. to 450 ft.) The motors do not have time to cool off under these conditions, and burn out very often. These conditions ought to be well understood before any decision can be made on the most advisable method of rating motors.

The association decided that the question should be taken up again next year, and that manufacturers of motors should be requested to contribute their opinions on the subject.

XI. STREET RAILWAY BRAKES

Mr. Monmerque, chief engineer of the General Omnibus Company, of Paris, had not been able to write a paper on this subject, as arranged, the replies to the list of questions sent out having been too few. He reviewed the conclusions of Mr. Fromm, presented at the Geneva meeting in 1898. These conclusions were as follows: First, for horse cars, the ordinary brake is sufficient; second, for cars operated by mechanical power, two brakes should be used, the hand brake and a mechanical brake; third, for railways operating on steep grades, a third special brake should be used, such as track brakes, etc.

This year only four replies were sent to the writer. They did not give any new information. Mr. Monmerqué asked that the association should adopt the following conclusions:

On account of the recent developments in mechanical traction, the subject of brakes can well be postponed till the next convention. The subject ought to be considered from both the standpoint of the local statutes on the subject and from a technical point of view.

These conclusions were unanimously adopted.

Mr. Monmerque then discussed the subject, giving some interesting information on the employment of brakes in Paris. Up to within recently the French companies were regulated on this subject by the law of Aug. 6, 1881, which is popularly called the rule of the "three-twenties." A car operated at a speed of 20 km an hour on a grade of 20 mm per meter (2 per cent) ought to be able to stop within a length of 20 m. This law has several practical inconveniences. In the first place it presupposes that the coefficient of adherence is constant and is equal to 0.14, but this coefficient varies enormously according to the condition of the rails, whether they are wet, dry or covered with mud. Under these circumstances it is very much lower than that assumed by the statute. As a result, a committee was appointed to draw up a modification of the rule of the

"three-twenties," taking these things into consideration. After six or eight years of investigation and discussion this committee decided to adopt the following rule, which was made public on Feb. 13, 1900: "A car operated at a speed of 20 km per hour on a *level* track with *dry, clean* rails, ought to be able to stop in 20 m." This modification is very important.

But in Paris this new rule has not been considered sufficient. There the rule of the "three-twenties" is in force, modified by the condition that the rails should be dry and clean. Article 152 of the police ordinances for July 10, 1900, reads as follows:

All brakes for motor cars and trail cars ought to be so powerful that if the vehicle be running at a speed of 20 km an hour on dry and clean rails and on a track having a down grade of 20 mm per meter, the vehicle will be able to stop within a space of 20 meters from the moment when the brakes are applied.

All tramway cars should be equipped with two distinct systems of brakes, or else two independent systems for operating the brakes, which should act on the wheels of the car. The brakes on the trail cars ought to be so powerful that where their action is added to the braking on the motor car, trains running with a speed of 20 km an hour on dry, clean rails and on a down grade of 2 cm per meter, will stop within a space of 20 meters or less.

Each system of brakes must be capable of being put in service rapidly, and of being applied by the motorman, conductor, brakeman or any employee on the train, by handles placed near each door of the car or cars.

One of these systems should be continuous, permitting the motorman or his assistant or any of the other employees on the train to brake all the wheels of the train instantaneously. This continuous brake should be capable of graduation, and should be exempt from all danger of breaking as well as of freezing.

On all trains operating on lines where the grades are more than 25 mm per meter (2½ per cent) the continuous brake used should in addition be so arranged with an automatic attachment so that, in case the coupling between the motor car and the trail car should break, the brakes will be immediately applied to the wheels of the trail car.

The braking apparatus should also be maintained in perfect condition, and it should also be so that it can be applied instantaneously at any moment.

Motor cars and trail cars should also be provided with the apparatus necessary for preventing the slipping of the wheels on the rails. The devices used for this purpose should be so efficient that the adherence between the wheels and the rails is as great as mentioned in the first part of this statute. The operation of this apparatus should also be within the easy reach of each of the employees to whom the operation of the motor cars, trail cars or train is confided.

These rigorous conditions are partly justified by the state of the streets in Paris, where the vehicular movement is very active, and where the rails are often covered by a slimy mud and grease, which greatly diminishes the coefficient of adhesion, but they do not prevent accidents, although it is probable that these accidents would be much more numerous were the conditions imposed less stringent. It seems as if every precaution had been taken. The cars of the General Omnibus Company are equipped with not less than five means of applying the brakes. Three can be applied by the motorman and two by the conductor. The motorman has at his disposition, (1) a compressed air brake, which can be operated gradually or for an emergency stop; (2), a hand brake; and (3), a brake secured by reversing the motors. The conductor can apply (4) the automatic air brake, and (5), the hand brake.

The direct-acting air brake gives a quick stop, and is intended for emergency service. It is liable, however, to flat the wheels. The automatic air brake gives a more graduated stop, and can be applied by the conductor in case of necessity. The hand brake does not call for any particular remark. The braking secured by reversing the motors can be applied to cars run by compressed air, steam or electricity. The best results are secured in connection with the first two. With electricity the results are less desirable, for if reversing is done too rapidly the armatures are burned out.

No car can be put in operation until its brakes have first been inspected by the engineers of the company, and then by the engineer of the municipality. Each morning the motorman tries his brakes to see whether they are in good condition, and this test is repeated during his trip. He is obliged to report promptly at the head office in case any defects should be noticed when the car is withdrawn.

The following example will give a good idea of the solidity of the brakes. A motorman having abandoned his post when his car had stopped at the top of a steep grade, the car commenced to run backward down the hill. The speed accelerated until the car was at the bottom, when it reached 60 km (40 miles) an hour. There the car entered a curve and was derailed. It crossed the street and commenced to mount the opposite curb, where it cut through a tree, the trunk of which was more than 30 cm (12 ins.) in diameter. The car was fortunately stopped by the curbstone. Many persons were killed and others wounded. The car was then put under seal and taken back to the car house. When the inquest had concluded, the car was taken out and all of its apparatus was found to be in perfect condition, and no repairs were needed.

Considering their number, their power, the care taken in their installation and in testing them, and in their maintenance, the brakes on the Paris cars seem to afford a guarantee of safety as absolute as could be secured; nevertheless, accidents are numerous. Why? Because, and this was the conclusion of Mr. Monmerqué, the employees do not use the brakes, or use them improperly.

MR. VON LEBER, government engineer of Austria, stated that in his country the first and foremost consideration for brakes was simplicity. It was not that the local conditions are favorable. Far from it. The ground is usually hilly and the grades steep and numerous. He remembered one grade with a length of 1500 m (4600 ft.) and of 11 per cent. However, they had never dreamed there of employing so many brakes as in Paris. Electric traction is used. The motorman has only to operate a single brake handle. This handle, turned in one direction, sends the car forward; turned in the other direction, it puts on the brakes. They have never had any accidents. Mr. von Leber explained that he and his colleagues did not consider themselves as looking upon the question in exactly the same light as a railway manager would. He and his colleagues are interested in not having accidents only so far as the protection of the public is concerned. They tried to secure this without specifying the exact methods to follow, because often a very short time after any rules have been formulated the discovery is made that these rules do not cover the case, or more improved apparatus has been designed, which renders them antiquated. The adoption of this simple method of braking gives good results. Each motorman knows his duty and can easily perform it. Simplicity leaves him at liberty to act according to his best judgment in the case of an emergency. Not even the most powerful brakes could stop a car within 20 m if the motorman allowed the car to run 30 m before applying the brakes. Mr. von Leber also remarked that in Austria the trains never consisted of more than two cars—a motor car and a trail car. When trains were longer than this it would doubtless be necessary to adopt special rules to secure safety, and especially to employ continuous brakes, operating on all the wheels of the train at the same time, but the speaker had not studied this question in a practical way, and did not wish to give any advice on it. In all cases the hand brake ought always to be employed as reserve brake.

On the subject of electric brakes, Mr. von Leber gave

the following information. Braking by reversing the motor had been tried, but had been abandoned as dangerous, as the motors burned out too often. They had then adopted definitely a method of braking by short circuiting the motors on a rheostat. The results obtained were very satisfactory. It is often said that this method deteriorates the motors. This claim is not well founded; thus on the steep line referred to above, where a grade of 11 per cent exists for a length of 1500 m, the experiment was tried of running the car down the grade at a speed of 25 km (15½ miles) per hour and closing the motors on a circuit through the rheostat. Immediately afterward the car stopped and the test was made a second time. At the foot of the hill it was impossible to notice any abnormal heating in the motors. All the heat seemed to be concentrated in the rheostat.

Mr. Fromm, of Kelsterbach, referred to the report made by the German Street Railway Association on the subject of brakes. Sixty-three companies have replied to the list of questions sent out by that association, and experiments have been made with different types of cars. The speed of the car being 22 km per hour, the minimum distance in which the car was stopped was as follows:

The rail being sanded, 9.50 meters to 10 meters (28.1 ft. to 32.8 ft.)
The rail being dry, 9.90 meters to 10.90 meters (30.2 ft. to 35.5 ft.)
With a wet rail 14 meters to 21 meters (45.9 ft. to 68.9 ft.)

The conclusions of the German report, so far as it concerns electric brakes, are that the system of braking in which the motors are short circuited gives satisfactory results as an emergency brake, but is liable to accidents if employed in regular service. When trains are heavy and there are many grades, the electro-magnetic brake should be adopted. Air brakes have given excellent results, but the use of these brakes has not been sufficient on any lines of sufficient length to allow the committee to draw any very definite conclusions about them.

Mr. Köhler, of Berlin, supported the proposition of Mr. Monmerqué that the question ought to be carried over to the next Congress. He asked that the companies should be more liberal with information. Brakes are extremely necessary in railway service. City officials are right in demanding their use, but extravagant claims are often made for them, and the companies ought to consider the question well before adopting any particular type. It is to the common interest that companies furnish all the information available on the subject.

Mr. Röhl, of Hamburg, stated that German companies, in studying the subject of brakes, had for their immediate object the disapproval of the claims made by certain municipal authorities who wished to compel all the authorities to use wheel guards or fenders. The companies thought that the best wheel guard is a good brake. They had made experiments and had endeavored to find out the *minimum* distance in which a car could be stopped. But since the report recited these tests and was to be made a part of the public proceedings of the Congress, it was only necessary to state that the length of stop obtained in the experiments was not the same as that which would be obtained in practice. The motormen knew that the purpose of the test was the operation of the brakes, and they commenced to apply the brake when they reached a pole indicated in advance. The conditions in practice are entirely different, as motormen are often obliged to apply the brakes at a moment when their mind is on something else. For this reason, allowance should be made for the coolness and quickness of the motorman, which form a most important factor. A new motorman, for example, would be apt to apply his brake so hard as to lock the wheels, in case of an emergency, when it is well known that the quickest stop can be produced by a more gradual application of the shoes against the wheels. In other words, consideration must be made of the coefficient of intelligence in studying this subject.

The figures contained in the report of the German Street Railway Association as regards the quickness of stops cannot then be considered as an exact criterion of the stops made in actual service, nor should they be so regarded either by the municipal authorities or by the local boards.

Mr. Janssen, who was in the chair, then closed the discussion, and the Congress voted unanimously to postpone final decision on the subject until the next session. The president then announced the business of the Congress as closed. After having thanked the delegates for the attention and the speakers for their papers, he declared the proceedings at an end.

Mr. Pavoncelli, of Naples, thanked the president for his courteous words, after which, upon motion of Mr. Köhler, a vote of thanks was tendered Mr. Janssen for the able manner in which he had conducted the sessions of the Congress.

Discussion of the International Steam Railroad Congress at Paris on Electric Traction

(From Our Special Correspondent.)

This Congress was held in connection with the Exposition at Paris, Sept. 20 to Oct. 1, 1900, and was attended by steam railroad managers and engineers from all parts of Europe and from the United States. About 1500 delegates were present, although the attendance was limited to official delegates of the principal trunk line railroads. The organization of the Congress was in charge of a committee appointed for the purpose by the International Railroad Association, the president of which is A. Dubois, general manager of the Belgian government railroads. The sessions were held under the honorary presidency of Pierre Baudin, Minister of Public Works of the French Republic, and had as its chairman Alfred Picard, Inspector General of Bridges and Highways, president of the Public Works Division, of Agriculture and of Commerce and Industry of the French Council of State, and also Commissioner-General of the Paris Exposition.

The programme contained forty papers, ranging, according to usage, under the following subject divisions:

First Section—"Tracks and Track Construction," 10 papers.

Second Section—"Rolling Stock and Equipment," 10 papers.

Third Section—"Operation," 9 papers.

Fourth Section—"Miscellaneous," 5 papers.

Fifth Section—"Light Railways," 6 papers.

Of these forty papers, two related principally to the subject of electric traction. A resumé is given below of the discussion of these subjects, as they proved of interest to readers of the Street Railway Journal.

The broad subject of electric traction, it should be stated, took an important position in the work of the Congress, and it was the first time which the delegates had considered the practical operation of electric railways. The power station at Moulineaux, which supplies current to the trains of the French Western Railway for its new line from Paris to Versailles; the Austerlitz electric power station and substation, which supplies current to the trains of the Orleans Railroad Company from Place Walhubert to the d'Orsay station; the electrical plant on the Champs de Mars, and that of the Invalides, which supplies current for the trains of the Western Railway Company between the Invalides and the Champs de Mars; the electric traction experiments

by motor cars of the Italian-Mediterranean Railroad Company, between Melun and Corbeil, were also visited by the delegates and inspected. All these excursions were repeated after several days' intermission to permit every one of the delegates, who were exceedingly numerous, to see them altogether and make a study of them.

The first subject of electric railway interest considered by the Congress was No. 20 of the second section, entitled,

INDEPENDENT MOTOR CARS

MR. E. SARTAIUX, of the Italian-Mediterranean Railroad, presented the paper on this subject, which was prepared by him in conjunction with Messrs. Kéroumès and Léchelle. He gave full details of the electric accumulator motor cars on the Belgium State Railways, of the steam cars of the same company, and of those of the Baldwin Locomotive Works; also of the electric accumulator cars on the system of the Italian-Mediterranean Railroad, of the Russian State Railway cars, of the steam dummy, narrow-gage cars of the Rowan system employed by the Société des Chemins de Fer Vicinaux, of Belgium; of the steam motor cars of the local railways of Vienna, which are practically locomotives; of the steam motors car of the French Northern Railway, designed especially for postal service, and of the electric motor cars of the same company.

MR. KRAMER added certain information about the electric cars of the Hungarian State Railway.

MR. E. SARTIAUX thought that motor cars (steam or electric) filled a certain province in railway work, not only on lines of light traffic, but also on suburban lines. On the former they could often be used to advantage instead of long trains, especially where the latter would have to be run at long intervals. On lines of greater traffic they could also be used to advantage; for example, in the belt lines of several large cities, where a short headway was required; also either ahead of or just behind regular trains to care for local traffic. He spoke particularly of the use of accumulator cars as being advantageous.

THE PRESIDENT of the second section spoke in favor of the conclusions of the speakers, and adduced some other facts in support of them.

MR. BAUDRY thought that the conclusions drawn from the paper were a little optimistic, for it seemed to him that motor cars hardly answered the purpose, in spite of some excellent results which had been secured in trials.

THE PRESIDENT of the third section said that most of the trials with this class of car had been very recent, and that sufficient time had not yet elapsed to determine definitely the cost of operation.

MR. BAUDRY, in his reply, said that some of the trials had been conducted long enough to determine this.

MR. E. SARTIAUX explained that, on the contrary, especially in the tests made by the Belgian and Italian railway companies, that all the trials had been recent, and that the results could be relied upon.

MR. BAUDRY objected to this, stating that the steam dummy had been used for a long time. Even if the electric motor car was a recent invention, he added that the inconveniences in the operation of motor cars more than counterbalanced their advantages, except under certain conditions.

MR. A. SARTIAUX thought that the advantages secured by the use of motor cars in the ability to increase the service without adding greatly to the expenses was important. He insisted that a difference should be drawn between motor cars run by themselves and motor cars which drew others. The report, although its title did not convey the idea, referred to both classes of cars. He added that it would be very valuable if the authorities would redraw the statutes which now cover the operation of motor cars so as to secure simplicity.

After a considerable discussion the section adopted the following resolution: "The employment of motor cars, either run by themselves or drawing one or two trailers, has been on a very limited scale up to the present, but it seems as if there is an opportunity for this development. It would be very interesting if trials could be made on this subject not only on lines of light traffic, but also on lines of heavier traffic. It would be very desirable if the companies could continue such experiment as they have made with this class of car. The Congress would be very glad to see such ordinances as apply to this class of car simplified so as to encourage their use."

ELECTRIC TRACTION

MR. AUVERT read a resumé of the report on "Electric Traction," which he had prepared for the second and fifth sections, in connection with Mr. Mazen. The writers had not thought it necessary to cover the subject in exactly the same way as outlined in the original title, and so had modified it. While the steam locomotive is capable of operating at a variable speed, electric locomotives, as at present built, can operate economically at only certain predetermined speeds. On secondary railways a constant speed for all trains could be employed without great inconvenience, but it is not the same on lines of heavy traffic. With the Sprague system all the cars of a train are motor cars, controlled from one point. This offers great advantages for lines with heavy grades, and also for rapid transit city lines, where the question of acceleration is an important one. The greater number of installations made up to this time have used direct current. Alternating currents at high potential are better adapted for lines of long distance, as the voltage can be reduced by various stationary transformers. Alternating current has been directly employed for car propulsion in Italy, and possesses important advantages. In summing up, the writer said that the installations already made show that electric traction is well adapted for secondary lines, but its advantages for lines of heavy traffic have not yet been demonstrated.

MR. MAZEN then presented an abstract of a paper written by Col. N. H. Heft for the Congress, and published in the STREET RAILWAY JOURNAL for Aug. 25 and Sept. 8 (International Edition for September). This paper described the employment of electric cars upon three feeder sections of the New York, New Haven & Hartford Railroad Company, as well as the application of electric traction to street railways. Mr. Heft thought that electric traction could be used to advantage by large railway companies.

MR. MAZEN expressed about the same opinion on this subject as Mr. Auvert.

THE PRESIDENT of the second section proposed the adoption of the following resolution based on papers read, viz.: "On secondary railways electric traction can be used to advantage, but for the operation of heavy trunk lines, except under special circumstances, the employment of electricity is not now considered desirable, at least the operation of locomotives drawing heavy trains." This proposal met with certain opposition.

MR. GERARD thought that the second part of the resolution should be divided and a distinction made between heavy trains and short and light trains. He thought that, so far as the latter was concerned, the advantages of electricity had been shown. On the other hand, he saw great advantages in the drawing of high-speed trains weighing from 250 tons to 300 tons by electric locomotives.

MR. RIGONI cited certain good results obtained in Switzerland by the direct use of polyphase currents.

Mr. Auvert pointed out several difficulties met in the employment of such, and among others that of regulating the speed of the motors. This included the inability to catch up with schedule time in case a train should be late.

Mr. Rigoni did not attach great importance to these difficulties.

A long discussion then followed, in which Messrs. Rigoni and Gérard, Mazen, Baudry and Cairo discussed the subject of current collectors and methods of conducting current to the car.

Mr. Rigoni praised the employment of overhead wires, where polyphase currents at high tension were used, but the other speakers thought, from the results secured in practice, that the third rail was preferable when the speed exceeded a certain limit.

Mr. Von Leber thought that considerable difficulty would be found in the employment of high-tension currents directly, and that this had been the result of the experiments in Italy.

Mr. Rigoni replied that in Switzerland, after a thorough set of experiments, that no such difficulties had appeared.

Mr. Cairo added that the same experience had been found in Italy. He gave a number of details as to the precautions adopted in the employment of high-tension curcuits.

This point was also followed by long discussion.

Mr. Solacroup remarked that in practice it was important to take the financial side of the question into consideration. He would like to see the technical side of the subject of the application of electricity to heavy electric railroading separated from a study of the economical side, for he thought that the real drawbacks to the employment of electricity in this work were almost entirely financial, but this statement is denied by a number of the members, and it would, therefore, seem very difficult to arrive at a satisfactory conclusion at present on the subject with so few data at hand as to the cost of operation. Another important element to which sufficient weight had not been attached, in his opinion, was the importance of traffic on the line under consideration.

Messrs. Clerault and Von Leber said that it would be premature to state that the problem of the application of electric traction to railway work had been solved even for secondary lines.

Mr. Campiglio thought that the use of electric trains on railway systems would introduce new questions of operation, on account of their lightness and greater frequency.

Mr. Baudry insisted on the importance of the tests which had already been made with polyphase currents, and on the service which it had so well rendered.

As a result of this discussion, the two sections finally passed the following resolution; "The Congress considers that actual progress has been made in the application of electric traction to certain railway lines operating under special conditions. This progress has been both technical and economical. The information at hand is not sufficient to determine yet whether this application is advantageous under all conditions of railway service, especially where heavy trains are run at high speeds over long distances."

M. R. Maltbie, editor of *Municipal Affairs,* has replied to the circular letter recently sent out by the Chicago Street Railway Commission with reference to suggestions as to the best method of procuring a suitable rapid transit service. Mr. Maltbie suggests the building of subways, and that the municipality at least should own the tracks, leaving the questions of control and operation in the hands of private companies.

Deterioration of the Peoria Standpipe

BY A. B. HERRICK

In a paper entitled "Electrolysis of Underground Metal Structures," read by D. H. Maury before the American Waterworks Association at Richmond, Va., in May, 1900, an attempt was made to show that the collapse of the standpipe at Peoria, Ill., was due to electrolysis, caused by electric railway return currents. This paper was later introduced as evidence in the test case for damages for the destruction of this standpipe, between the Peoria Water Company and the Central Railway Company, of Peoria.

An abstract of the portion of this paper referring to the standpipe, as it appeared in the *Engineering News,* is reprinted below:

On March 30, 1894, the water company's steel standpipe on the West Bluff burst, killing one person and injuring fifteen others, one of whom died later from his injuries. Upon examining the wreck of the standpipe, the writer at once noticed a peculiar pitting of the inside of the vertical sheets, and the appearance of these pits was so different from that caused by any ordinary oxidation that he was soon almost positive that they were due to electrolytic action. A similar standpipe on the East Bluff was drained, and was found to be similarly pitted. The whole inner surface of the vertical shell appeared to be thickly covered with blisters resembling in outward appearance the tubercles sometimes found inside of old cast-iron mains. This blistered covering, which was almost as thin as paper, was composed entirely of oxide of iron, and on brushing it away with the finger tips, the black paint with which the standpipe had been originally coated would be found beneath it. The black paint was oftentimes almost unbroken, or, at least, very slightly cracked. When the paint was brushed off, the pit would be disclosed, considerably smaller in area than the surface covered by the blister. The surface of the metal in the pit was perfectly bright and clean, and its fiber was clearly discernible. Many of these pits were more than ⅛-in. in depth. They were slightly more numerous in the West Bluff pipe than in the East Bluff standpipe, and were in both generally larger and deeper on the lower courses of the vertical shell.

FIG. 1.—VIEW OF WRECKED STANDPIPE AT PEORIA, ILL., SHOWING PITTING ON UPTURNED PIECE, DUE TO ELECTROLYSIS

(The two largest blotches are streaks of mud.)

Fig. 1 is a photograph of the wrecked standpipe, the upturned corner of the torn sheet near the center of the picture showing the pitted appearance of the surface, the blisters having been, of course, shaken off by the fall of the metal, and the metal itself having become somewhat oxidized before the photograph was taken. Fig. 2 is from a photograph of a small sample of steel from the standpipe, and shows the pitting in the sheets around the edges of the rivet heads.

It seemed advisable to secure a thorough expert examination with a view to determining the cause, nature and extent of the observed pittings on the standpipes, and injuries to the piping system. Stone & Webster, of Boston, were selected to make this examination. The work, in which the writer, from time to time, assisted, covered seven weeks on the ground, and the reports submitted by Stone & Webster fully confirmed the suspicions that the pitting was caused by electrolysis, and established the fact that the entire piping system of the water company

would be endangered by a continuance of the existing electrical conditions. The West Bluff standpipe was distant about 60 ft. from the street railway line on Bourland Street. The East Bluff standpipe was about 700 ft. distant from the railway line on Knoxville Avenue. Both standpipes were more than a mile from the power station, and were negative to the rails. The electrical examination relative to the standpipes was conducted mainly at the East Bluff standpipe, which was still in service. A flow of a part of the current from the railway line was clearly traced through the earth to the anchor bolts which held the standpipe to its foundation, as shown in Fig. 3, up these bolts and into the steel of the shell, and through the shell and from its inner surface to the projecting section of the 16-in. flanged cast-iron pipe which served as both inlet and outlet, and which connected the standpipe to the water mains. The current was then traced along this pipe and along the mains to the power station. The deflections of the voltmeter needle were clearly traced to the railway current, being especially influenced by the one or two cars on the line beyond the standpipe on Knoxville Avenue, and when the cars stopped running at night, the movement of the needle ceased. Where the current left the inner surface of the shell to pass through the water to the inlet pipe it made the pits already described.

Fig. 4 is from a photograph showing the interior surfaces of three sections of this inlet pipe, marked A, B, and C, respectively, the positions occupied by these sections originally being shown by the letters A, B, and C in Fig. 3. An examination of the photograph shows the strongly marked and numerous pits which were found inside the sections A and B, while the inner surface of the section C was found to be practically as smooth and perfect as though new. When the condition of the inside of these three sections of pipe was first noted, it seemed hard to understand why A and B should be pitted, while C was unaffected. A closer examination, however, showed that in the flanged joints between the bottom sheet of the standpipe and A and B, respectively, corrugated copper gaskets were used, while the pipe B was separated from the pipe C by a thick rubber gasket; and that under the nuts and heads of the bolts holding the flanges together there were grummets or wrappings of cotton wick soaked in tallow. The result of the arrangement was, that the current which entered A,

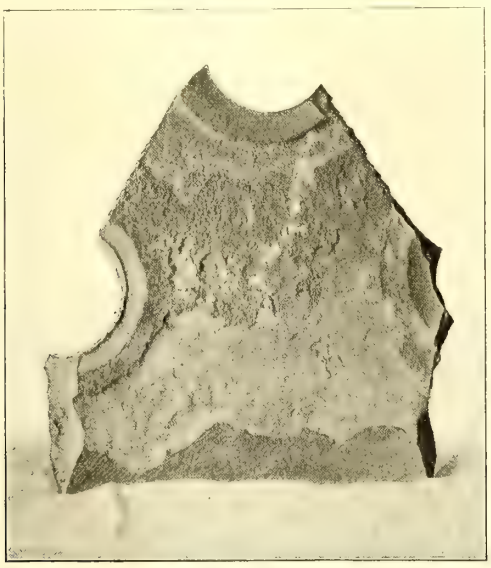


FIG. 2.—VIEW OF FRAGMENT OF PEORIA STAND-PIPE, SHOWING PITTING AROUND EDGES OF RIVET HEADS

after passing through the water from the inner side of the shell of the standpipe, and which was trying to return along the inlet pipe and water mains to the power station, encountered, at the joint between B and C, the rubber gaskets and grummets. The effect of the gasket and grummets was to practically insulate the section C from the section A and B, and as none of these pipes were in contact with the ground, the current was compelled to leave the pipes A and B and travel through the water or along the slimy coating of oxide on the inside of the pipes around the joint between B and C, in order to continue on its journey. As the current was not leaving C, this pipe was not injured, but the current, in leaving the inner surfaces of A and B did pit them, as shown in the photograph.

These standpipes and the inlet pipes were negative to the rails, and are striking examples of electrolytic pitting under such conditions.

The coroner's jury reported that, after having made a careful examination, both mechanically and chemically, of this standpipe, the failure *"was occasioned by the use of inferior material in construction."* William D. Pence in a report published in his book on Standpipe Accidents and Failures regarding the metal used in this standpipe, stated:

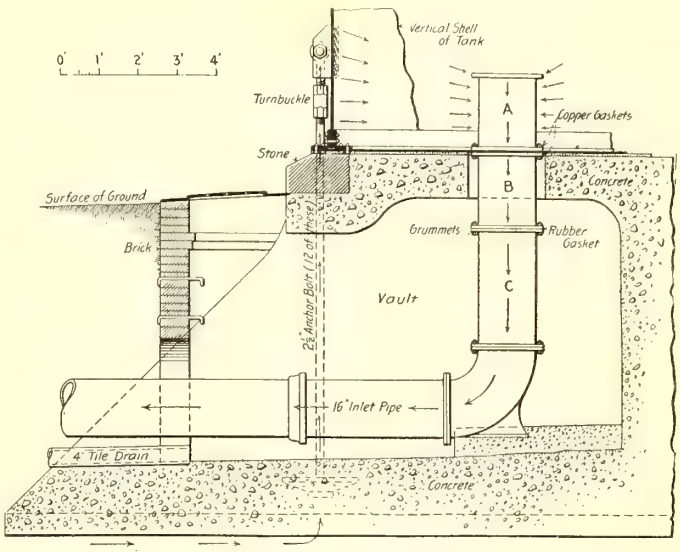


FIG. 3.—MAURY'S DIAGRAM, SHOWING FLOW OF RETURN CURRENT

"No physical test of this piece (referring to sample of this standpipe plate) was made, because it broke off short in the attempt to cut out a sample piece." In regard to the initial rupture, Prof. Pence says that this took place at or near the point on the north side of the standpipe where calking was in progress, and occurred at the time, or a moment before the standpipe collapsed.

It is evident from the above that these authorities do not consider that the failure of the standpipe could be attributed in any way to electrolysis. But let us consider further. The pittings found on the interior of the shell, it is assumed by Mr. Maury, were caused by the action of the current from the ground return of the railway company.

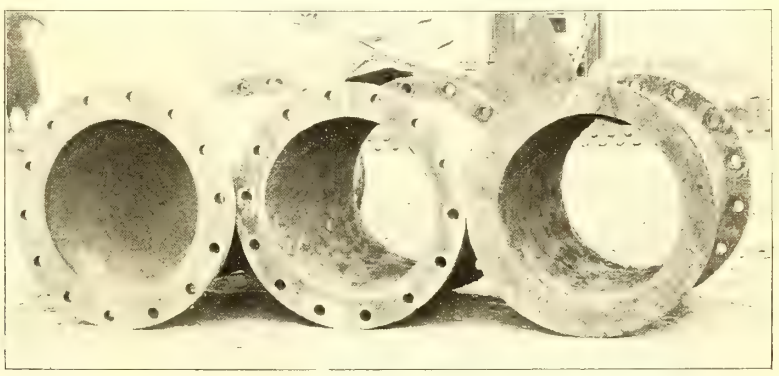


FIG. 4.—INTERIOR VIEW OF LENGTHS OF INLET TO STAND-PIPE, SHOWING PITTINGS IN A AND B, AND EFFECT OF INSULATION OF C

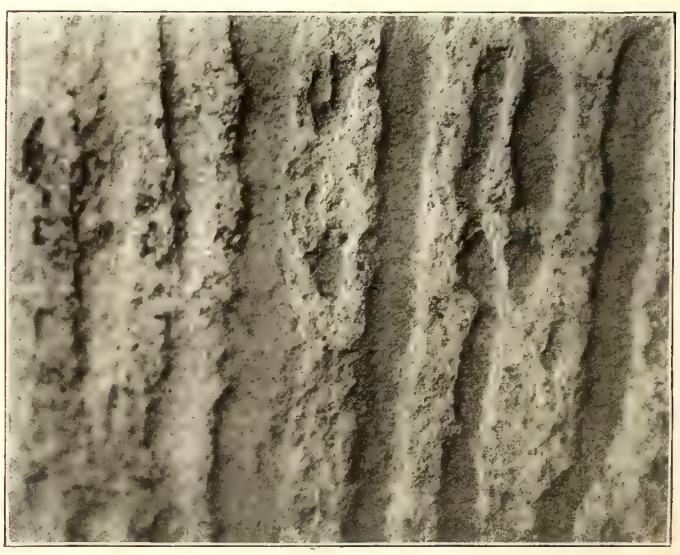
Mr. Maury shows, in Fig. 3, the course this current would take in order to produce the pitting on the interior of the shell and outlet pipe of this standpipe. Pitting of this character is well known. Technical journals, such as the *Engineering News,* are full of records of cast iron, wrought iron and steel being pitted, and the descriptions of the blisters or tubercles are identical with Mr. Maury's description of what he found on the interior shell of the standpipe.

This action is very extensive in some cases, and I will cite an instance, which D. J. Lewis related before the Society of Mechanical Engineers at their meeting in Cincinnati in regard to the interior of a penstock, examined in 1893. This penstock was used by the Merrimac Water Company, and became pitted before any electric railways were located near it. He states that "the interior was covered with barnacles as large as 2 ins. in height, and 1½

FIG. 5.—REPRODUCTION OF PITTINGS FROM STAND-PIPE IN RARITAN NOT DUE TO ELECTRIC RAILWAY

ins. in diameter, and on their removal the metal was found badly pitted, as deep as 3-16 in. in places."

Figs. 5, 6 and 7 show the pitting of a standpipe located at Raritan, N. J., between the canal and the river, there being no electric railways within many miles. This standpipe was taken down on account of the severe pitting action of water on the internal surface, which certainly shows a great deal worse condition than that exhibited by Mr. Maury in Fig. 2.



FIGS. 6 AND 7.—REPRODUCTIONS OF PITTING AT RARITAN, N. J., NOT DUE TO ELECTRIC RAILWAY

Fig. 7 shows a very remarkable grooving produced in this standpipe plate, as these pits seem to be from one edge of the plate to the other in nearly parallel lines.

In Fig. 8 will be found a larger diagram, showing the relative locations in Peoria of the railway, the water main and the equalizer leading to the standpipe; the arrows show the relative flow of current from the railway system to the water pipe. It will be noticed that, in the distribution of current in the railway, the current leaves the rails and passes 80 ft. to the standpipe; on reaching the latter it has to pass underneath the concrete foundations into the anchor bolts, D. In doing this it has to pass by the 16-in. main, which carries this current back into the piping system again. How this current flows against itself to and from the standpipe cannot be explained by any known laws of distribution of current over potential surfaces.

Again, in order to sustain this theory of electrolysis, the current has to leave the pitted sides of the standpipe and reach the flange A in order to affect the internal sheets of the standpipe as claimed; it has also to pass through the water circuit instead of the metallic circuit formed by the iron bottom of the standpipe to which flange A is connected. The measured resistance of the metallic circuit, which shunts the water circuit, shows the relations of these two circuits to be over 890,000 to 1. In other words, the natural laws of electricity have to be distorted to account for the depreciation of this standpipe from electrolysis.

The pitting of A and B, in Fig. 4, and not C, can be readily accounted for by the fact that A and B, being part of the standpipe structure, were not of the same composition as pipe C, and were made by the standpipe manufacturers. This iron runs high in phosphorus and carbon, and it is well known that this composition is much more readily corroded by water than cast iron.

It can be seen from the photographs, Fig. 4, that the top flange of A and the surface around the bolt holes are pitted. If the current did flow from the sides of the shell to A, these surfaces should not have been pitted, according to Mr. Maury's statement.

The measurement of potential made on the standpipe shows, as might be expected, high resistance between the stay bolts imbedded in concrete foundation and the ground. Each of these bolts was measured with a potential of 500 volts to discover if by any conceivable means current, to produce the pitting complained of, could have been introduced into this standpipe, but if it had, it would not have taken the path indicated in Fig. 3, due to its preference to a metallic low-resistance path over a high-resistance water path.

It was further found, in connection with the electrolysis

power station, that the Peoria Water Company had established a metallic connection between the water pipe system and the rail returns by locating its gate boxes directly against and electrically connected to the rails, thus forcing current into the water pipe system. The position of the rails in the streets is fixed by ordinance; the gate box location is at the option of the water company.

It behooves the water companies, then, to use reasonable care in the construction of their water pipe systems, so as not to introduce directly into their systems the current of which they complain. I am familiar with a number of cases where, due to improper construction, they have voluntarily connected the water mains so as to form, by the water mains, an auxiliary return to the rail return.

In regard to the electrical measurements on this standpipe, it should be stated that the soil surrounding the standpipe and on the bluff is clay of fairly high resistance. Any two iron grounding rods stuck in the soil several yards apart, at this location, will show a difference in potential. A much more marked difference will be found when one rod is stuck in the ground and the other connected to the water pipe, for then the water pipe acts as a pressure wire over a larger potential area. Tests made by Mr. Maury by measuring the potential between the standpipe bolt and the 16-in. water main were not tests duplicating the conditions that existed before the collapse of the standpipe.

If an officer of the water company wished to find the flow of water in a pipe, and sent out a man to determine it, and if the latter should report that there was 80 lbs. pressure, it would not be rash to come to the conclusion that the man was ignorant. Yet in the question of electrolysis potential differences are given as a criterion of the electrolytic conditions existing, whereas the only thing that has any bearing on the subject is the current flow.

As the effects of oxidation from the natural action of the soil and its constituents, and those caused by oxidation from decomposition by electrolytic action are identical to visual and mechanical examination, and whereas a special chemical examination will disclose whether the residue was produced by electrolysis or ordinary corrosion, in equity, it should not be assumed that all rust or pitting (where the pipe is positive to the rail) is caused by electrolysis; for this is throwing, by an unwarranted assumption, on the railway companies the burden of maintaining the water pipe systems, which are positive to and paralleling their tracks, against natural depreciation.

The investigations carried on by water companies are in some cases placed in charge of electrolytic enthusiasts, who will unfold tales of horrors that are going to happen by the wholesale destruction of the water mains due to the silent but inevitable action of the diverted railway return current. This has happened periodically for the past seven years, but the fear of danger has now nearly passed, except when expressed in scare lines in the public press, for nothing serious has yet happened that could be attributed, even by the water companies involved, to electrolysis.

Where the railway and water companies can mutually co-

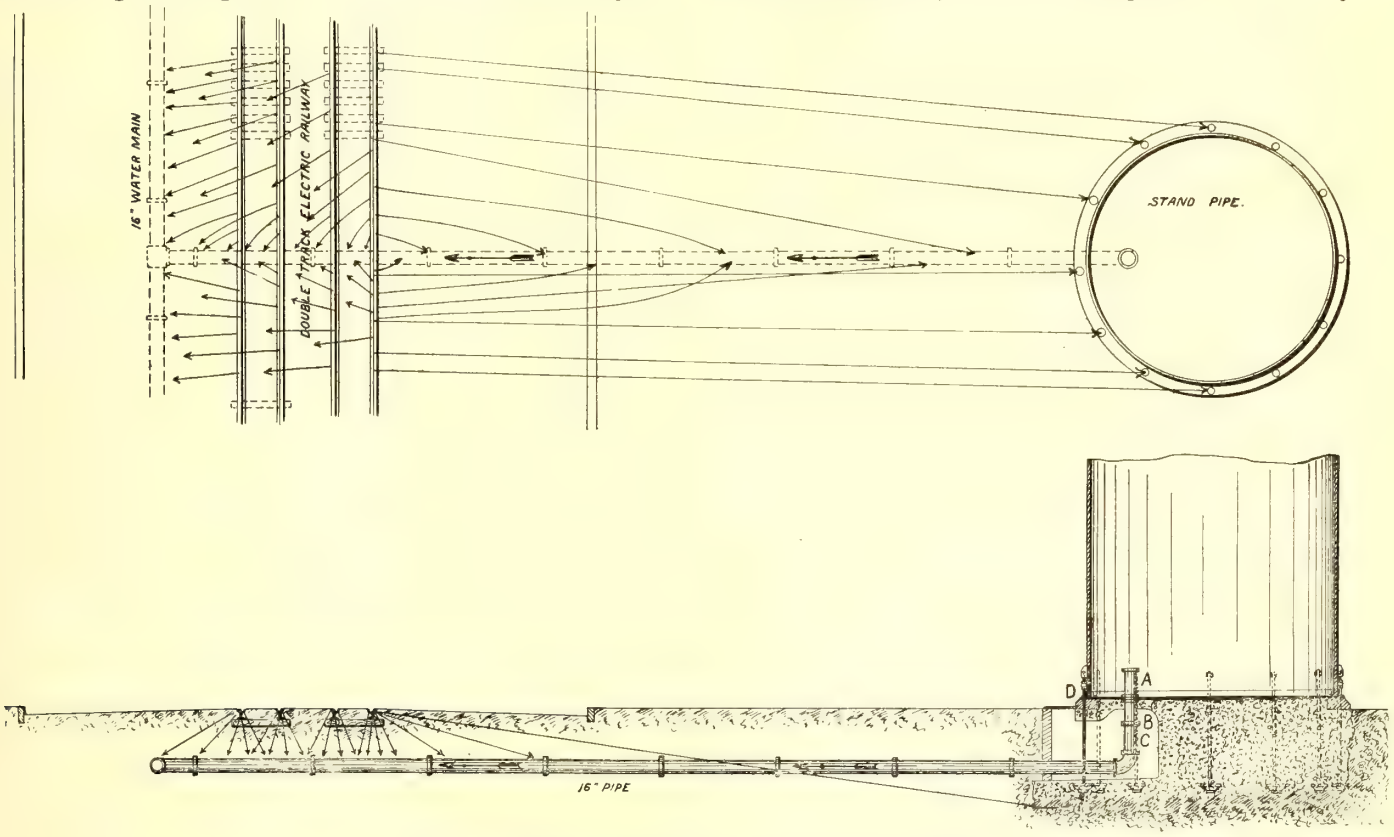


FIG. 8.—CORRECT DIAGRAM OF CIRCUITS AT PEORIA

operate in carrying out such changes in the existing systems, and where they adopt such methods as are well known and have been in operation for years, the problem is a simple one. But where relief at law is the resort chosen by the water company, it is necessary (even in this case) that justice may be done by the processes of law, for guilt cannot be assumed until proven. This legal axiom should be followed in scientific investigations to insure the disclosure of the true causes for any particular phenomenon observed; such examinations mislead the observer if undertaken only to prove a presupposed case.

Mr. Maury's solution for electrolytic difficulties is for the railway companies to erect a double trolley system. In support of this he cites the well known Cincinnati construction, and also says:

> In Washington, D. C., all roads within the city limits are required by law to have a complete insulated underground metallic return for their current, and by recent acts of Congress, passed on account of electrolytic injury caused by the single trolley system, the overhead double trolley is required in all other new or amended charters within the District of Columbia.

The real conditions in Washington are shown by a letter,

published in *The Electrical World and Engineer* for Oct. 20, from Walter C. Allen, District electrical engineer. The last two paragraphs of this letter are abstracted herewith:

Owing to the efforts of the District authorities to require all lines within the District to be double trolley, and to the fact that their efforts will undoubtedly result in securing legislation to that end, the company voluntarily rebuilt the line on the double trolley system. It is, however, not operated as such, but is operated as a single trolley line with a ground or rail return, which accounts for the statement in this article that the rails have been bonded at the joints.

Of the nine railway companies controlled by the Washington Traction & Electric Company in the District of Columbia, only one of them is required by law to operate with the double trolley system. In rebuilding the lines over which they secured control, however, they have equipped four of them with the double trolley system, among which is the one mentioned in this article.

It is evident from the above that the railway companies do not wish to use the double trolley unless forced to do so by law.

CORRESPONDENCE

Tractive Resistance on Street Railways

British Electric Traction Company,
Norfolk Street, London, Oct. 15, 1900.

Editors Street Railway Journal:

In a recent editorial you discuss tractive resistance of street railway cars, and state truly that the amount of knowledge on this subject is singularly small.

It should not be difficult for engineers to get together a considerable amount of experience, or rather of the results of experience, if they would only make an occasional test of a car under varying conditions as to load and weather. The probability is that they would be surprised to find how small was the resistance due to the motor. It is desirable that this should be known, however, and it may easily be obtained for the more important case of the motors being driven by the car rather than when driving the car, for in the former instance the wheel is driving the pinion, and the friction is probably a maximum. The resistance of the motor or motors can be arrived at by difference. The car may be allowed to drift down hill under the influence of gravity only, and in full working order. The motors may then be disconnected, and the car again allowed to drift and the resistance calculated from the difference in the times. For this purpose a gentle declivity of as uniform a grade as possible should be selected of about 1 in. in 90, to 1 in. in 100, or about 50 ft. to 60 ft. per mile. The grade should not be so steep as to necessitate the use of the brake. A distance of about 400 yds., more or less, may be selected, the length being to a considerable extent determined by the choice of the grades, for a grade flat enough not to accelerate the car too much will permit of a longer drift without excessive speed being attained.

Very good results may be secured with no further marks of distance than are afforded by the poles of the overhead system, but as these are not usually spaced at identical distances, and are perhaps too widely spaced also, it will be found an improvement to use wide lathes, painted white, and these should be observed by an observer through a vertical opening, which can be made by means of a slit in a paper pasted over the car window. Time may be recorded from a clear center seconds watch, hung so as to be visible to the observer, so that he may read the time as the post passes the eye. The equal spacing of the poles simplifies the drawing of curves of performance, and also the calculations.

A convenient recording instrument would be a well-regulated clockwork-driven strip of paper, on which the observer would press a mere dot as each pole was passed. Recording clocks, as often used with their paper movement controlled by a fan at the end of the wheel train of the clock, are not reliable. The control must be given by a balance wheel, and with an accurately driven paper band the time can be measured off after the test. Fan-regulated movements are useless for timing; they are not merely inaccurate, but give inconsistent results when wound more or less fully up or down.

Speed records may be taken by a tachometer, if required. This driven off, the axle of the car will give results that can be read fairly well, and are fairly consistent with other observations, but speed can always be calculated from the time records and post intervals probably as accurately as it can be read from a dial.

When more extended tests are to be made the current used by a car when running with current may be measured from a recording ammeter on the usual traveling band of paper. Instruments devised for this purpose by Mr. Sudworth have a band that travels at the rate of 3 ins. per minute, and the average current used on any run can be found by setting the points of an Amstler planimeter to the length of the diagram and finding the mean height in the usual way. If a diagram extends beyond the range of the planimeter it can be divided exactly in halves or thirds, and each measured separately, and averaged with the other or others. The exact voltage may be similarly recorded by another similar instrument.

If a car be released from rest at the top of the chosen gradient, and allowed to descend freely under the influence of gravity, it will gradually accelerate its speed, and will pass the posts in decreasing intervals of time. The results can easily be plotted in curves by setting vertical ordinates to any convenient scale on a horizontal line, and drawing horizontal abscissæ from a vertical scale of time to each post. The intersections of these lines with the post lines are points in the curve.

It is necessary to have an accurate measure of the levels of the rails at each post, in order that the gravity calculations may be made. It is a well known fact in mechanics that a body falling freely a distance of 16.1 ft. will do this in one second, and will attain a final velocity of 32.2 ft. per second. The effect of gravity is thus described as an acceleration of 32.2 ft. per second in one second. For this it is necessary that the body should fall along a radius of earth, *i. e.*, vertically. But no matter what may be the the path of descent of a body, it will still acquire the velocity of 32.2 ft. per second if it descends 16.1 ft., but the time required will be longer. If an absolutely frictionless mass be allowed to descend a grade having a total fall of 16.1 ft., it will acquire the velocity of 32.2 ft. per second, whether the grade be 96.6 ft. long or 966 ft., but in the one case the time of descent will be performed in six seconds, and in the other case in sixty seconds, the ratio of time being inversely as the tangent of the inclination.

In order to obtain a datum for comparison we may assume first a frictionless car, and find the velocity it should obtain. The formula for accelerating is

$$V = \sqrt{2\,g\,H}, \text{ or } 8.025\ \sqrt{H}$$

where $g = 32.2$, and H = total declivity. In a given case where the total fall was 9 ft. in 900, the acquired velocity per second would thus be $8.025\ \sqrt{9}$, or 24.075 ft. We may neglect the decimal for present simplicity, and call $g = 32$. Then the acquired velocity will be 24 ft. per second. The car having started from zero, the mean velocity is 12 ft. per second, and the time required to pass over a distance of 900 ft. is 75 seconds. Had the fall been vertical the time would have been .75 second. The slope being one in one hundred, the time is multiplied one hundred fold. In fact a grade may be regarded as a parallel with the Attwood machine

for exhibiting gravity effects. Gravity is thus reduced in its effect to the one hundreth of its normal intensity, or 0.32. If gravity is reduced to this fraction it naturally follows that to produce the effect of gravity on a level would demand 22.4 lbs. of tractive effort per ton (2240 lbs.). A 7-ton car would thus demand a tractive effort of 156.8 lbs. to produce the effect of a grade of 1 per cent.

Let the case be now taken of a car that descends the same grade in 150 seconds. Here the mean speed is 6 ft. per second, and the maximum is 12 ft. The effect of gravity is such that V. is now 12 ft., and the velocity equation becomes $12 = x\sqrt{9}$. Therefore $x = 4 = \sqrt{2g}$, and the effect of gravity is thus only 8. In other words, as gravity still exerts its customary acceleration of 32, there must be some force now acting to oppose gravity. The magnitude of the opposing force is obviously the difference between 32 and the new gravity, or $32 - 8 = 24$. As the grade is still 1:100, the value of the retarding force is 0.24. Then $.24 \times \frac{1}{g} \times 2240 = 16.8$ lbs. per ton.

This is the resistance of the car axles, its motors, the rails and the atmosphere, and closely corresponds with a recent test made by the writer on a grade of 1 in 95.5, which showed 16.88 lbs. per ton on a clean rail at a mean velocity of 6.28 ft. per second over a distance of 835 ft., or about 120 lbs. for a 7-ton car. As this resistance was exerted over a space of 900 ft., we have a total resistance in foot-pounds of $900 \times 120 = 108{,}000$, spread over two and one-half minutes, or 43,200 foot-pounds, or at the rate of about 1 1-3-hp per minute for the given velocity. The usual statement of resistance in pounds per ton may, however, better be kept to, and we may state that a double motor car of four wheels will have a resistance of about 17 lbs. per ton, at a mean speed of 6 miles per hour. We may know from this that car resistance must have provided for it, say, 20 lbs. per ton, and that all tractive force beyond this may be assumed to be available for acceleration or hill climbing.

In an ordinary, well-maintained, oil-lubricated car of the type named, run on a clean rail of grooved type, it appears from other tests that of the total resistance to traction about half is due to the four axle bearings and the remainder to the machinery, rails, etc., but further experiment is needed to confirm this *opinion,* which, if correct, points to the importance of care in the maintenance of these bearings that are apt to be more neglected than perhaps the motor bearings or suspension brasses.

WILLIAM H. BOOTH, M. Am. Soc. C. E.

Kinks of the North Jersey Street Railway Company

On this page are illustrated some ingenious devices in use in the shops and on the road of the North Jersey Street Railway Company. The first cut shows a useful device which has been in service for some time at the Newark repair shops. This is a trolley-pole straightener, and gives very satisfactory results. Considerable power can be exerted by the screw, and bad twists can be removed without greatly injuring the tubing. The cut gives a good idea of the general appearance. The pole is straightened by placing it on the hooks, with the convex side toward the screw, and tightening until the bend is taken out. The whole apparatus is about 2 ft. long, and can be used without removing the trolley pole from the car.

In the next engraving is illustrated a handy appliance for adjusting the sprocket chains of sweepers. It consists of a turn-buckle with a hook at each end, the length when screwed out being about 3 ft. When in use, the ends are hooked into the links, and, with a few turns, the chain is drawn tight. The operation of fastening or unfastening the connecting links is facilitated by the shape of the hooks, as the curves allow easy access to the chain.

The difficulty of replacing portions of the rattan in snow-

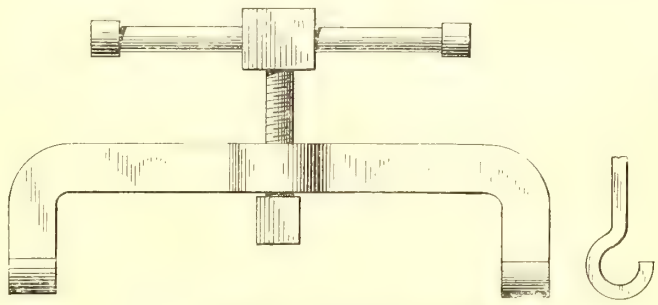


FIG. 1.—TROLLEY POLE STRAIGHTENER

sweeper brooms and the liability to uneven wear, which necessitates such changes, has led to the invention of a sectional broom for use on this road. The accompanying engraving shows the broom, which has been patented by H.

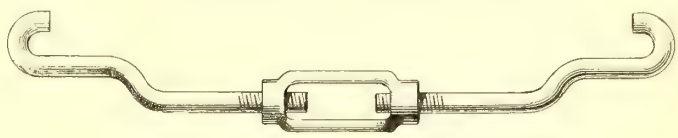


FIG. 2.—ADJUSTABLE LINK FOR SWEEPERS

H. Adams, master mechanic of the company, with two of the sections removed. As can be seen from the detail drawings of the device, each independent section consists of a row of bunches of rattan bent around a board and

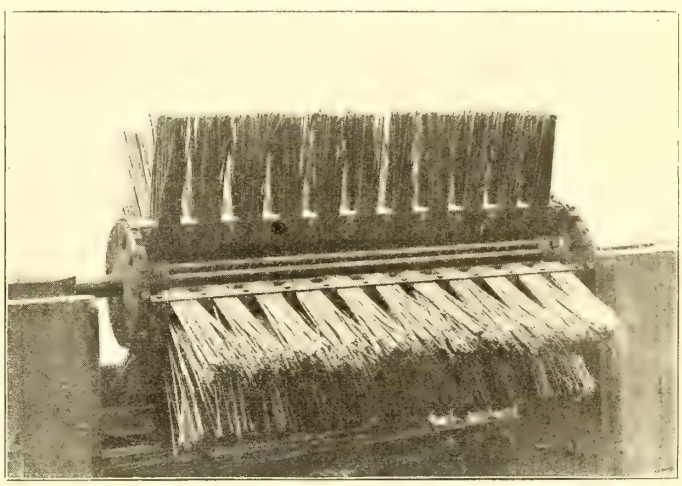


FIG. 3.—NEW TYPE OF BROOM

held in place by iron strips bolted along the edge. Blocks are placed between the bunches so that a large amount of rattan is saved without affecting the efficiency of the broom. When a section is in position it is secured

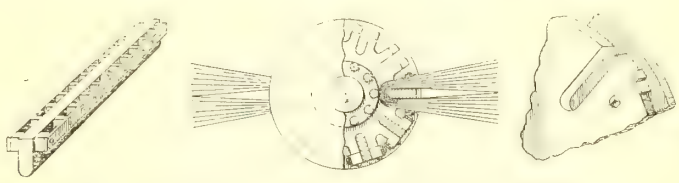


FIG. 4.—METHOD OF FASTENING THE RATTAN

by clamping strips similar to the one shown in the last figure, and the bunches of rattan are held firmly by the backing or retaining bars, which are fastened permanently to the spider heads. A section may be removed while the broom is in position, and the bunches replaced by new ones without loosening any other bolts.

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The first official trip of an electric train with the new equipment on the Manhattan Elevated Railway, of New York, occurred Nov. 22, and marked an important epoch in the history of the company, as well as in that of the transportation system of New York City. To those who have ridden on the electric elevated railways in Chicago the trip was of no great novelty, although the operation of the cars was excellent, and reflected great credit on the engineers in charge. To the New York public, however, the new train was a revelation of what electric power in elevated railway service can do, and the quickness of acceleration, the absence of jolting in starting and stopping, and the cleanness of the equipment and operation excited widespread and most favorable comment. The engineers expect to have the entire Second Avenue line in operation by the end of this year, and probably by April will have engines turning in its new power station at Seventy-Fourth Street and East River.

* * *

New York during the next year will present a scene of the greatest activity in electrical construction, particularly in station work. The Metropolitan Street Railway Company will be engaged upon completing the 216th Street station, formerly belonging to the Third Avenue Railroad Company. This station was originally planned for 96,000 hp, and was described in the Street Railway Journal for January, 1900. Under the present plans it will be completed to one-quarter its originally planned size, and will supplement the output of the Ninety-Sixth Street station of the Metropolitan Company. The latter station, although practically completed so far as operation is concerned, will necessarily be the scene of considerable activity during the next year, with the perfection of details which the necessity for current has prevented the company from making up to the present time. The new station of the Manhattan Elevated Railway, with its 11,000-hp units, is now progressing rapidly at East Seventy-Fourth Street, and the extent of the work there will necessarily prevent its entire completion by December, 1901. As indicated in the plans which have been published, this station will be about as large as the two generating stations combined of the Metropolitan Street Railway Company at Ninety-Sixth Street and 216th Street. In addition, the New York Light, Heat & Power Company is about to build a still larger station on East Thirty-Eighth Street, the plans calling for a capacity not far from 150,000 hp. These projects are entirely outside the requirements of the new Rapid Transit Railway, whose underground work is now being actively carried on in a dozen different sections of the city. No announcement has yet been made of the power plans of this system, but while the franchise of the company allows any kind of power except that which produces combustion in the tunnel, it is safe to say that electricity will be used, and that the consumption of power on its line will be at least equal to either of the other two railway systems of the city, surface and elevated. Altogether, New York City seems to be in an excellent way toward being provided with ample power facilities sufficient for the needs of the city during the next several decades.

About once a month we notice in the daily papers a revival of the electrolysis scare in some city or another of this country. The announcement is usually made in the large headlines that the entire sub-surface system of gas and water pipes is being slowly but surely destroyed by the return current of some electric railway, and householders are warned that they are in danger from gas explosions in the street, caused by escaping gas, or that the local fire department may be deprived of its supply of water at a critical moment if the electric railway is not enjoined against using a grounded return. The public is usually duly terrified by these announcements, and the excitement lasts until some other subject comes up to distract its attention, and the whole subject is then forgotten. Occasionally, however, the alleged injury is made the basis of a damage suit, brought by the water or gas company against the railway company. The most famous of these suits was that brought by the Peoria Water Company against the Central Railway Company, of Peoria, the complainants alleging, among other injuries received, the destruction of its standpipe through electrolytic action of the return current of the railway company. This claim is most effectually discussed by Mr. Herrick in an article in this issue, in which he not only shows that the alleged trouble could not have been caused by the railway return circuit, but also proves most clearly that damage of a precisely similar character, or greater, has occurred in standpipes many miles distant from any electric railway. It might be interesting to cite here the actual causes which have been brought against railway companies for alleged damage by electrolysis through the return current. One of these was at Spokane, Wash., where the judge decided that all danger of this kind could be avoided by the use of a particular kind of bond, which the railway company agreed to adopt, and the case was then dropped. A second is the Peoria case, which is still under adjudication. The city railway companies of Dayton have also been sued, and the case is still in the courts.

It would be an interesting question as to how to trace any alleged damage in the case of several operating companies in the same city. If damage is found, or if the water company thinks that it has found evidence of electrolysis, it would be a serious problem to proportion such damage between two or three railway companies which traverse the territory in which the pipes exist. It is not enough to prove that the injury was caused by a return circuit, but the particular amount of damage which each company caused would have to be shown—to collect damages. This argument would not apply to a company operating all the lines in a city, but might be effective where two or more systems occupy the same territory. The water companies, however, are working together in this matter to a considerable extent, while as yet the railway companies have taken no united action on the subject. While we do not believe that the result of this litigation will be in any way different from that of the early telephone litigation with electric railways, in which the effort was made by the telephone companies to compel the railway companies to give up the ground return in favor of a complete metallic circuit, there is no doubt that greater public education on the subject is required.

The proceedings of the International Street Railway Congress, which are published in extended form in this issue, will be found of great interest to readers on both sides of the Atlantic. The Congress, which was held in Paris during the Exposition, was made coincident with the regular biennial meeting of the International Street Railway Association, which comprises the principal street railway companies of Europe outside of England, and its proceedings have always commanded great respect. The list of subjects selected for discussion was quite comprehensive, and included subjects of motive power, power distribution, track construction, rolling stock, equipment and operating details. The custom of the association, by which the author of a paper submits with his paper certain conclusions derived from it for endorsement by the association, was productive of considerable discussion, and was an excellent means of eliciting the combined opinion of the members of the association on the topics under consideration. Two of the most interesting features of the meeting were the condemnation, by practically all the delegates who spoke, of the storage-battery system of traction and the insistence, where the advantages of "electric traction" were referred to in the other papers, that the overhead system was the one understood and intended. In this respect, street railway practice abroad has shown a very marked change in sentiment. During the early days of electric traction, while the overhead system was being installed and developed in America, the energies of European engineers were being devoted principally to the endeavor to produce storage-battery cars which would operate. The overhead system was regarded as a barbarism, and money was unreservedly spent in the purchase of new types of batteries and forms of plates. Many American managers were confronted by the local authorities in their different cities with the inquiry as to why storage-battery cars could be made to give good service abroad and were not considered commercially practical in this country. It seemed as if "climatic conditions" could be the only reason possible. But the truth had finally to come out, and it would seem as if the vast expense to which many of the European companies have been put in the attempt to operate storage-battery cars had, if anything, served to intensify their opposition to any compromise on the subject. It is doubtful whether in the meeting of any American street railway association such sweeping condemnations would have been uttered. The other subjects discussed and the expressed sentiment of the association upon them were, briefly, that the use of transfers could not be separated from a great many disagreeable features; that electric lines should, if possible, be built standard gage; that the cast-welded joint had been demonstrated to be a valuable improvement for street railway tracks; that heaters were an undesirable portion of the equipment of a car; that a standard rating for tramway motors is desirable; that too little attention has been given to the subject of brakes, that this is a very important feature of street railway operation, and that it could well be studied by street railway managers to advantage. These conclusions, with the exception of that on heaters, might very well have been adopted by any representative American street railway association without exciting much comment.

* * *

It seems, however, that within a week after the close of the Street Railway Association, the International Railroad Congress, comprising representatives of the principal steam railroads of the world, discussed electric traction to a considerable extent, and, surprising as it may seem, considerable attention was paid to accumulator traction. Whatever the advantages that accumulator traction may possess, many would naturally suppose that they would not be particularly evident on a line operating over its own right of way, and where high speed is usually desired. Nevertheless, it is interesting to note that the Steam Railroad Congress treated accumulators with much greater respect than the managers of the European street railway companies, whose scant courtesy to this method of traction characterized their Congress. It is undoubtedly true that on long lines of very light traffic, where single motor cars are run only every hour or so, and where consequently the transmission is over a long distance, while the load is light and fluctuating, the ordinary direct-current system of distribution does not show up so advantageously as under other conditions. We doubt, however, whether many steam or electric railway engineers in this country would advocate storage-battery cars for a condition of this kind. If electricity had to be depended upon, we believe that either high-voltage transmission with rotary sub-stations and storage-battery boosters would be preferable, or an attempt would be made to develop a market for electrical power at other points along the line to equalize the load.

* * *

It appears somewhat strange that the modern electric heater should not have followed other American improvements on the European electric tramway systems. Municipal authorities abroad have paid the greatest attention to the brake question, and are more rigorous in their requirements for brakes than are those in this country. They are also very strict in regard to the drop of voltage on the return circuit, and have compelled the companies to introduce many refinements in this particular which are not considered necessary here. The heating of cars, however, has not been considered of as much importance. The reason can not be due to climatic conditions, because in

many of the cities of France and Germany the winters are often as severe as they are in our Eastern and Middle States. The reason is undoubtedly due to the fact that no satisfactory system of heating has ever been applied to European steam railroad coaches, and that the public consequently has not been educated up (or down) to being warm while traveling. Europeans traveling in this country often complain about the degree of heat in our steam cars, and claim that it is productive of colds, caused by passing from the heated car to the outside air. We believe that while American cars, both steam and electric, are more overheated than underheated, there is a considerable field in Europe for the modern electric heater.

We have met recently frequent inquiries concerning the results that should be reached in electric railway practice while using various coals and mixtures of coals. To answer them in particular is an almost impossible task, but at the risk of boring a few of our technical friends, we desire to call the attention of our readers in general to some considerations touching the use and efficiency of fuel. While the world's coal supply is by no means in imminent danger of early or even remote exhaustion, it certainly is a fact that the actual condition of our coal supply, with respect to production, is such that there is serious danger of steady appreciation in price. To a considerable extent the fuel supply is now controlled by a few groups of producers, who are by no means disposed to enter into cut-throat competition, to put the case mildly, and it behooves large coal users to take account of the situation with an eye to remedial measures. From the general use of high-grade steam coal we are passing to the employment of mixtures that ten years ago would hardly have been considered salable. It is the economic value of these which constitutes the standing puzzle of to-day in steam production. To begin with, one can determine with a high degree of precision the total output of a station in kw-hours, and the indicated horse-power necessary to produce it at the engine under working conditions. Tracing power production back a step further one can readily find the weight of dry steam required, again, under working conditions, to give one indicated hp-hour. We fear from experience that in many stations the analysis of the matter is not carried even to this point, but it ought to be. At this stage of the proceedings the economy of engine and dynamo becomes evident, and the next step is to analyze the conditions of steam production. Here the real difficulty begins. By measuring the water by meter, and the coal by weight, one can get at the coal required to evaporate a given amount of water under working conditions, but this is only half the story, and the smaller half at that. The next obvious step is to find the evaporation at various stages of the station load, in other words, to separate boiler efficiency from engine and dynamo efficiency. If one merely ascertains the coal consumption per kw-hour, he does not find out whether his boilers are doing their work properly or not. But figuring out the work of evaporation done, it is at once apparent whether the boilers are being pushed too hard at full load, whether they waste fuel at low loads, and whether on the whole they are doing reasonable duty.

The proper duty of a boiler, however, depends mainly upon two things; first, the quality of the fuel, and, second, the manner in which it is burned. In relative importance this order should be reversed. Boilers are rated for their efficiency on carefully fired coal of the best quality, such as Pocahontas, and the best boilers will evaporate, under the standard conditions, from 9 lbs. to nearly 13 lbs. of water, according to the care with which they are fired. Right here is a variation of 25 per cent to 30 per cent in the net return from the coal. If the engine and dynamo builders were responsible for such uncertainty in efficiency, they would find it desirable to hastily leave in disguise for Tangiers. Even with the best coal burned in furnaces, known by long experience to be adapted to it, there is, thus, a great variation, due to the skill of the fireman. Certain boilers require a special knack in firing to get the best results. One familiar type, for example, works beautifully, and produces an astonishing amount of steam with a thin and very even fire over the whole grate surface, but let the first once get irregular and lumpy, and the fireman will nearly break his back to get half the output. With relatively poor fuel, difference in firing is even more serious.

As to thermal value, the finest American coals give a total of about 15,000 B. T. U. per pound, more generally a little over 14,000 B. T. U., while a low grade of slack may give less than 11,000 B. T. U. But in point of fact the actual difference in thermal power between first-class steam coal and the scrubbiest mixtures of pea, dust and slack, is far less than one would naturally suppose, and much less, too, than the differences found in the evaporative power of the best coal under different conditions of firing. In other words, poor coal, well fired, will do as well as the highest grade of coal badly fired. Moreover, as a rule, the meanest mixtures of cheap coal are capable of good economic results, if properly burned. But calorimeter tests alone are not a safe guide, since they show merely the total calorific power, and tests under the boilers may be very deceptive, as merely proving that the furnaces and the habits of the fireman suit one kind of fuel better than another.

The problem actually before steam users to-day is to find out how to burn low grades of coal efficiently. A calorimeter test shows what the fuel might do in evaporation, and the next step is to see what it can be made to do. We have, therefore, traced economical power production back to the furnace and the fireman. The conditions of economy in dynamos, engines and even boilers, are fairly well known, but the practice of past years has tended to evolve furnaces suited to standard steam coals, and methods of firing fitted to these furnaces. To meet the new conditions which have grown up in recent years, there is needed a large amount of careful study of the furnaces and methods of combustion suited to relatively cheap fuels, mixtures of bituminous and anthracite pea, dust, slack and culm, to low-grade coals, and to coke, which must not be forgotten in reckoning with the fuel question.

In the final results of power at the switchboard it matters little where waste occurs along the complex course between the coal bin and the bus-bars, so long as it exists. But for some strange moral reason the station manager attaches, generally, great importance to differences of a few per cent in the efficiencies of his dynamos and engines, while a loss of 10 per cent or 15 per cent, due to improper furnaces, unskilful firing, gets lost in the shuffle. How the electricians would bestir themselves if there were a good fighting chance to raise dynamo efficiencies by 10 per cent! Yet, right before us is a task of equal economic importance to every steam-driven station, and one worthy of the most persistent efforts.

Notes and Comments on the Street Railway Accountants' Convention. II and Conclusion

BY A. O. KITTREDGE, F. I. A., C. P. A.

The question of where taxes shall be placed, whether this item is to be regarded as an operating expense or to be treated as a deduction (?) from "net" earnings, will not down. A cloud no bigger than a man's hand has appeared upon the horizon, and while, according to the report of the committee on a standard system of accounting, it may be safely disregarded, for it does not think it will be much of a shower in any event, yet there are others who look at that little cloud as something of far greater importance and likely in the course of time to prove an uprooter of certain old ideas. The committee's report alludes particularly to the transactions of the convention of the National Electric Light Association, held in May last. A paper was read on that occasion on uniform accounting, which in a sense criticised the Street Railway Accountants' Association for treating taxes as a deduction from income, taking the position that taxes by right should be considered a part of operating expenses. Not only did the author of the paper take this position, but the association formally indorsed that conclusion. The paper in question not only classified taxes as an operating expense, but brought into the same category interest on current liabilities, allowances for depreciation, and certain other reserves. The reason stated, as the chairman of the committee on standard system of accounting reported to the convention, was that these accounts ought to be included among operating expenses, instead of deductions from income, in order that the true cost of production could be determined.

* * * *

The gentlemen of the committee on standard system, it seems to me, were disposed to handle this matter somewhat gingerly, for they put forward the statement that they do not care to provoke any further discussion of the subject. In effect, the committee washed its hands of the whole matter after submitting the facts of the case for the information of the association. It very cleverly dodges the responsibility of a further consideration of the general question by asserting that it did not believe that the Accountants' Association would be wise in criticising the position taken by the other association on questions of accounting.

* * * *

I take it that this cloud no bigger than a man's hand is likely to grow until it overspreads the street railway accounting sky to such an extent that no one can avoid its shadow or fail to be aware of its presence, even though his eyes are shut. Accounting principles are eternal, inflexible and all pervading. Any violation of them and any deviation from the course that their correct interpretation would point out will have to be atoned for or adjusted sooner or later. Interstate commerce commissions, State Railroad Commissioners and other bodies more or less legal in their organization and duties, may prescribe and dictate as to classification; they may formulate reports and hold companies to them, but if their demands are wrong in principle, sooner or later they will be changed, for in the end right will prevail.

* * * *

The Street Railway Accountants' Association at various times during its existence has stumbled on several points. For example, it has not always clearly seen the difference between the capital invested in a street railway represented by bonds and that represented by stock. It has at different times called all of it capital. This view may be correct from the investor's point of view, but it is wrong from the companies' standpoint. Just at present, apparently, the association cannot see the identity in effect of those expenses which are under the control of the management and those which are established by law, like taxes. It pretends to see a difference in these two classes of expenses which warrants a difference in treatment. When the question of depreciation of plant or the establishment of a reserve to provide for replacement of plant came up some time since, various members of the association exclaimed hastily: "We are not ready for that yet." Perhaps they will be ready for it and still other advanced features in the near future.

* * * *

The difficulty of the present situation is that the gentleman who read the paper before the National Electric Light Association sees the case clearly and correctly. On the other hand, the street railway accountants are apparently groping in the dark. But ultimately, as said before, right will prevail. Sooner or later the street railways of the country will have offered them, at the hands of this organization or by some other authentic source of supply, a system of accounts that is logically correct and theoretically perfect. They have not, however, reached that point yet so far as the association is concerned. The system that will be presented when the correct idea is reached will undoubtedly employ the present classification of expenses, but it will arrange in the general scheme a balance sheet and profit and loss statement upon a plan strictly conforming to accounting principles.

* * * *

The address before the convention by John I. Beggs, on "What the General Manager Wants to Know from the Accounting Department," was both interesting and instructive. Mr. Beggs lays down as a broad rule that the manager stands for the board of directors, and that the board of directors stands for the stockholders and that the stockholders are the capitalists who are investing in the enterprise. Therefore, what the manager wants to know proceeds from his conception of the stockholders' interests. No one can gainsay this standard or object to it is a foundation principle. From this point of view he argues first for honesty, integrity and reliability upon the part of the persons employed, both principals and subordinates, and finally leads up to such a statement of the condition of the company's affairs as would be just not only to the stockholders, but also to the bondholders, and to the municipality as well from which the franchise is derived. The yardstick or unit of measurement thus presented by Mr. Beggs is one that the association could well apply to the system of accounts which it will ultimately work out. Whatever fully and completely satisfies these conditions will meet all requirements, and ought to be satisfactory to every one. Those accountants in the general field who most nearly accomplish in their work a presentation of what the business man wants to know, arranged as the business man wants to know it, most nearly meet actual requirements and give the greatest satisfaction to their clients. The conditions in street railway accounting do not differ from those in ordinary business.

* * * *

The discussion on the unit of comparison, as well also as Mr. Mackay's paper on the subject, was important. I was particularly impressed with the statement of Secretary Brockway that in New Orleans several different lines produce results that seem to warrant the use of several different units of comparison. It would seem that the experience of the street railway accountants in this matter is not essentially different from that of accountants in the

general field, having to do with miscellaneous industries. The effort to establish a unit for street railway purposes resembles in some respects the search for a unit in manufacturing enterprises, although the use of the unit sought in the latter case is somewhat different from that of a railway enterprise. In manufacturing, some basis must be established upon which to spread the general manufacturing expenses so as to let each item of product stand its own proper pro rata. The expenses to be spread in a manufacturing enterprise correspond in a sense to the general expenses of a street railway operation. In manufacturing they include rent of factory (in case it is a rented property), insurance, taxes, superintendence and foremanship, reserves for repairs and depreciation, heat, light and power, and other items of the same general sort. The unit that works most satisfactorily in one case is not the best in another.

* * * *

In a machine shop the man-hour unit is sometimes preferred. In a foundry it would be pounds of castings. In a cotton mill, producing muslins, for example, it would be square yards. In a blast furnace it would be tons of metal. In a rolling mill it would be pounds or tons of sheets or bars or beams, as the case might be. Comparatively few manufacturing enterprises, however, are single propositions. There is very often a considerable aggregation of small industries combined in one company. There are concerns which operate both a foundry and a machine shop, and still others which, in addition to these two divisions, have a woodworking plant. Now, it is obvious that pounds of castings would not be the proper unit to employ either in the machine shop or in the wood shop, and that the man-hour basis would not be satisfactory in the foundry, no matter how advantageous it might be in the other divisions. The result is that accountants use different units in different establishments, and different units for different divisions of the same establishment.

* * * *

Mr. Vreeland very aptly illustrates the difficulty of the situation so far as street railway men are concerned, by what he said concerning the complex conditions under which different portions of the railway system under his direction in New York are operated. With cable roads, different sections of which operate at different rates of speed, with under trolleys and over trolleys, with compressed air cars, and last, but not least, with numerous horse cars still in use, a single unit, that would be of advantage, seems doubtful, if not absolutely impossible, save only as it is employed in each division separately, and in each case carefully supported by specifications of conditions. Comparisons of results between different divisions could only be made in the light of the statements of condition. The association did wisely, it seems to me, to reach the conclusion that it did in this matter, as set forth in the report—namely, that it "recommends the use of the car-hour as a standard unit of comparison, with the understanding that it is to be put to a practical test with each company represented in the association, either in connection with the car-mile or not, as they may see fit, and that the committee report back at the 1901 convention."

* * * *

One difference betweeen the units employed by manufacturing companies in the distribution of expenses and the unit which the street railway companies are seeking should be noted in this connection. In manufacturing, it is a question of the distribution of general expenses, as already pointed out. In street railway work it is a basis of representing the relative cost of expenses and also the relative income derived from the line. The tests which will be made of the car-hour in the next year will be both interesting and valuable. The discussion at the present convention served to bring to the attention of every one who will undertake to test the relationship of several different standards to the question at issue, and also very clearly indicated the points at which comparisons could be made. All who experiment and go up to the next convention with their results will be the bearers of some very valuable information.

* * * *

It would seem from following all that has been presented on the subject, that the ultimate use to which the standard unit is to be put, after it has been discovered and agreed upon, is comparisons of one company's results with those of another, or the results of one division of a company's business with others. The comparison will naturally have to be made on a double basis, first, with respect to expense, and, second, with respect to income. It was pointed out in the discussion that some divisions are operated with a high expense relatively, yet are profitable because the income is proportionately high. From this it appears that to make the assertion that a road is operated at 22 per cent or at 50 per cent, or with some other result, amounts to nothing, save only as it is explained. It is only the net results in the way of profits that answers the question that is up for settlement. Even though the expenses of one line be five times as much as those of some other line, yet if the income is proportionately greater, the stockholder is quite as well satisfied as though the same net results had been obtained upon a lower schedule of both expenses and earnings. A practical scheme for discovering and stating what are the net results from a line is really the only plan that will be satisfactory to the accountant and to the stockholder.

* * * *

At the Niagara convention of the Street Railway Accountants' Association the mention of material and supplies accounts developed the fact that only one or two of the delegates present had in practical use in their accounting systems anything of the sort. In the interval since that date much progress has been made in this regard. Far more companies to-day are giving attention to the accounts necessary to take care of materials and supplies than were doing so at that time. Accordingly, Mr. Barnaby's paper was much more apropos at this date than it would have been at an earlier convention. The problem that Mr. Barnaby discussed is one that is encountered in various enterprises besides street railways. It is one which underlies the proper conduct of steam railways, and is one also which is ever up for consideration in manufacturing establishments of all kinds. There are two general plans in use: One is to dump all the materials and supplies bought into the operating or manufacturing accounts at the time that they are purchased, and the other is to keep separate accounts of materials and supplies, charging into operation or manufacturing, as the case may be, only those items that are actually consumed.

* * * *

Very slight consideration of the question shows that the latter plan is the correct one, but there is involved in it, first, the need of a well-devised system for the purpose, and second, a certain amount of clerical work for maintaining it. A proper view of this question is to be obtained only in the light of a broad generalization upon accounting principles. The value of the quantity of materials or supplies on hand at any time is essentially an asset. That which is consumed in the operation of the road is an expense. That which remains on hand is something that would go into the balance sheet statement among the resources, while

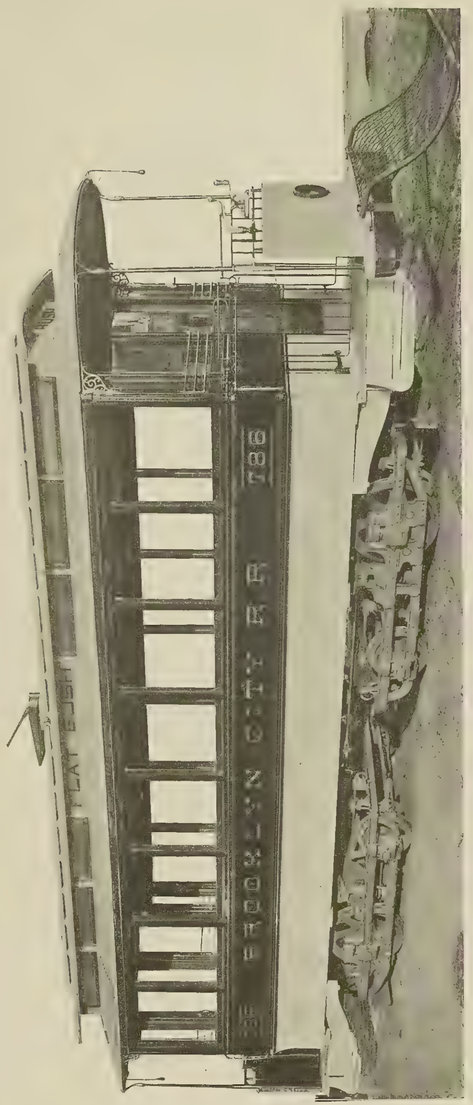


FIG. 595.—BROOKLYN STANDARD CLOSED CAR

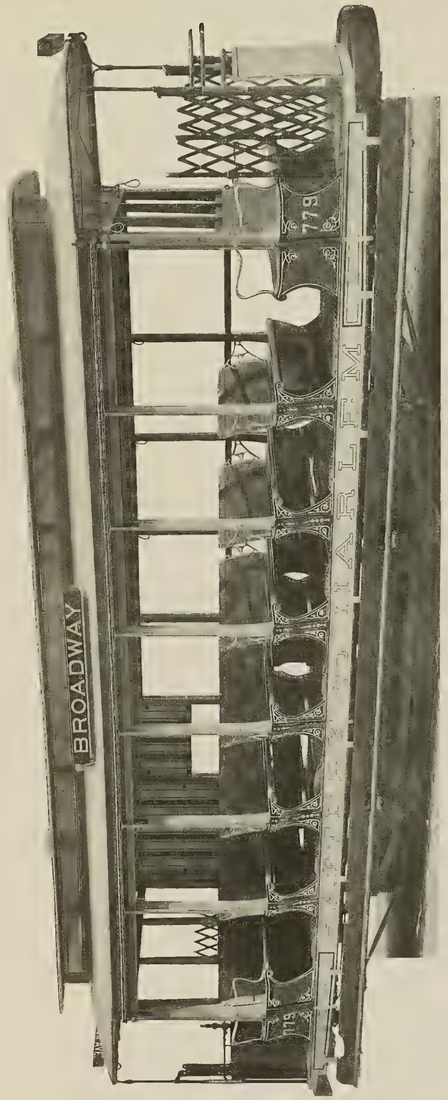


FIG. 596.—METROPOLITAN STREET RAILWAY (NEW YORK) STANDARD OPEN CAR

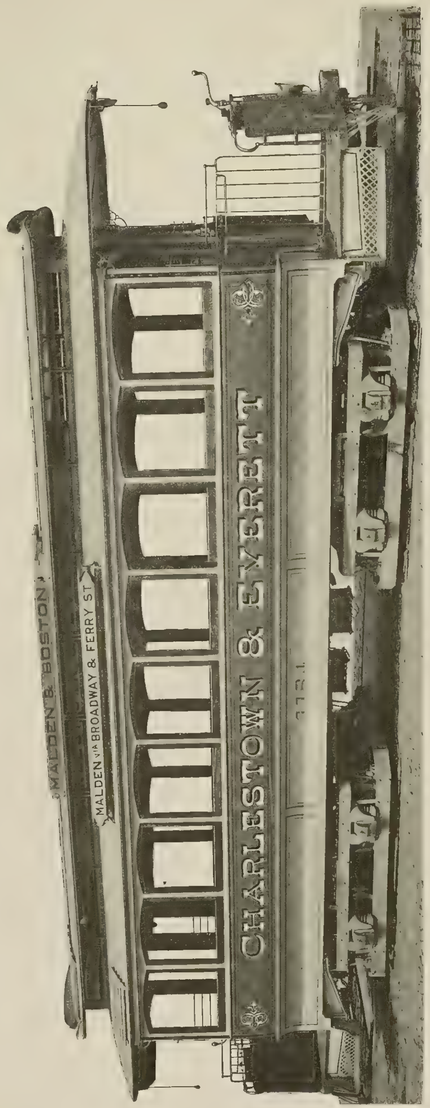


FIG. 597.—BOSTON STANDARD CLOSED CAR

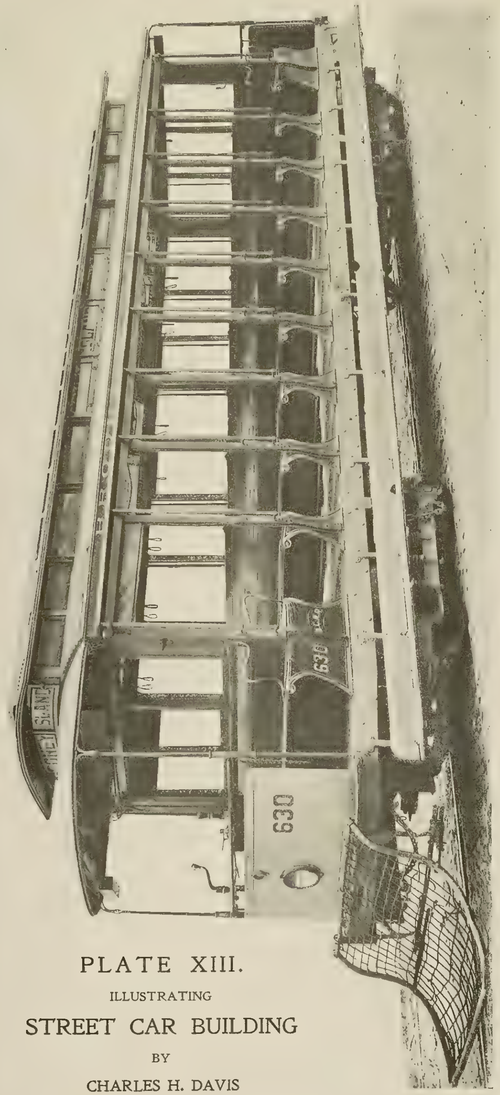


FIG. 598.)—BROOKLYN STANDARD OPEN CAR

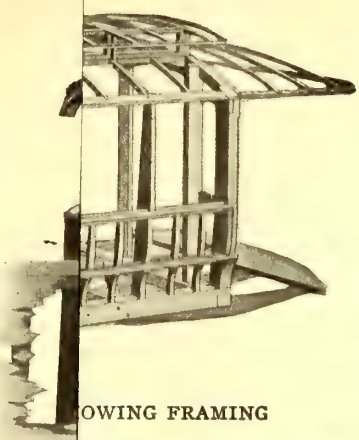
PLATE XIII.

ILLUSTRATING

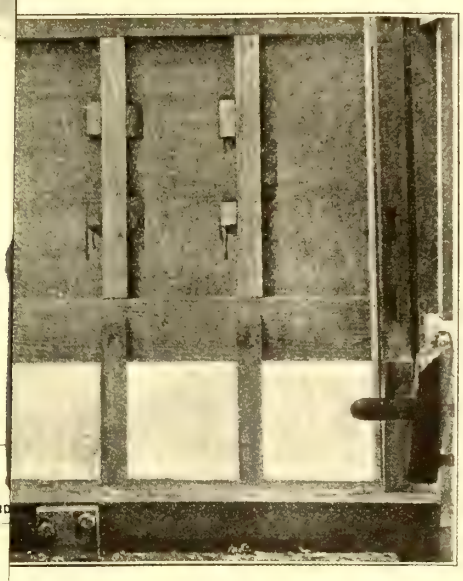
STREET CAR BUILDING

BY

CHARLES H. DAVIS



OWING FRAMING



SIDE OF PANEL (BOSTON CAR, 1896)

PLATE XIV.

(Figs. 599 to 625)

ging Practice

....IN....

t Car Building

ILLUSTRATING

EET CAR BUILDING

(Stephenson Practice)

....BY....

RLES HENRY DAVIS, C. E.

FIG. 623. METHO

FIG. 599. CHEAP METHOD OF JOINING END AND SIDE SILLS

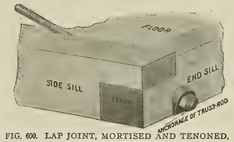


FIG. 600. LAP JOINT, MORTISED AND TENONED, OF END AND SIDE SILLS

FIG. 601. DETAILS OF LAP JOINT SIMILAR TO FIG. 600

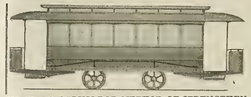


FIG. 602. LOW TRUSS-ROD METHOD OF STRENGTHENING BOTTOMS TO PREVENT SAGGING OF ENDS

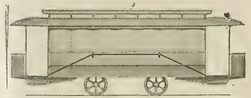


FIG. 603. HIGH TRUSS-ROD METHOD OF STRENGTHENING BOTTOMS TO PREVENT SAGGING OF ENDS

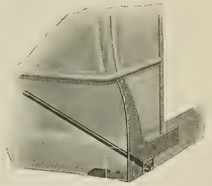


FIG. 604. DETAILS OF CORNER, SHOWING SILLS, TRUSS ROD AND CORNER PLATE

FIG. 605. DETAILS OF TIE RODS FOR CROSS SILLS

FIG. 606. DETAILS OF POSTS SETTING INTO SILLS

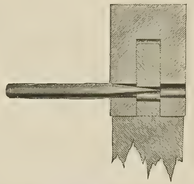


FIG. 607. DRAW-PINNING A MORTISED AND TENONED JOINT

FIG. 608. TOP PLATE IN POSITION

FIG. 609. TOP BELT SCREWED ON TO POSTS AND TOP PLATE

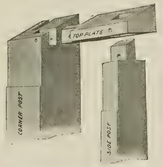


FIG. 610. DETAILS OF POSTS SETTING INTO TOP PLATE

FIG. 611. DETAILS OF END HEAD PIECE FRAMED FOR AN "ACCELERATION" (DOOR)

FIG. 612. DETAILS OF HEAD PIECE AND POST JOINT

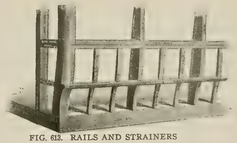


FIG. 613. RAILS AND STRAINERS

FIG. 616. DETAILS OF CARLINE, TOP PLATE AND SIDE POST

FIG. 614. DETAILS OF JOINT BETWEEN RAIL AND SIDE POSTS

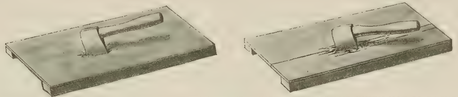


FIG. 615. EFFECT OF INJURY TO PANEL WHEN BACKED WITH "SCRIMS" AND WHEN NOT SO BACKED

FIG. 617. TROLLEY-BRIDGE

FIG. 618. EFFECT OF GLUE AND LACK OF SAME ON SIDE PANELS WHEN REMOVED

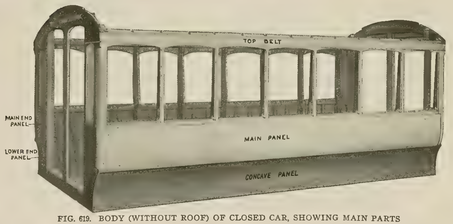


FIG. 619. BODY (WITHOUT ROOF) OF CLOSED CAR, SHOWING MAIN PARTS

FIG. 623. METHOD OF PUTTING PANELS IN PLACE

FIG. 624. VESTIBULE (IN THE WHITE)

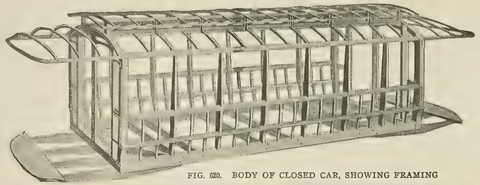


FIG. 620. BODY OF CLOSED CAR, SHOWING FRAMING

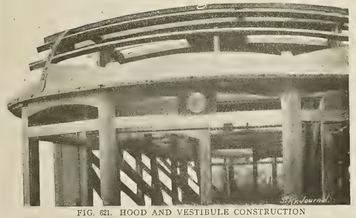


FIG. 621. HOOD AND VESTIBULE CONSTRUCTION

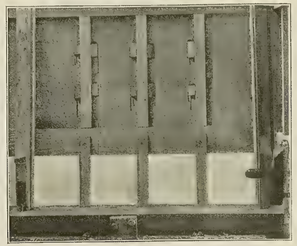


FIG. 622. INSIDE OF PANEL (BOSTON CAR, 1896)

FIG. 625. FRAMING OF VESTIBULE

PLATE XIV.

(Figs. 599 to 625)

Varying Practice

....IN....

Street Car Building

ILLUSTRATING

STREET CAR BUILDING

(Stephenson Practice)

....BY....

CHARLES HENRY DAVIS, C. E.

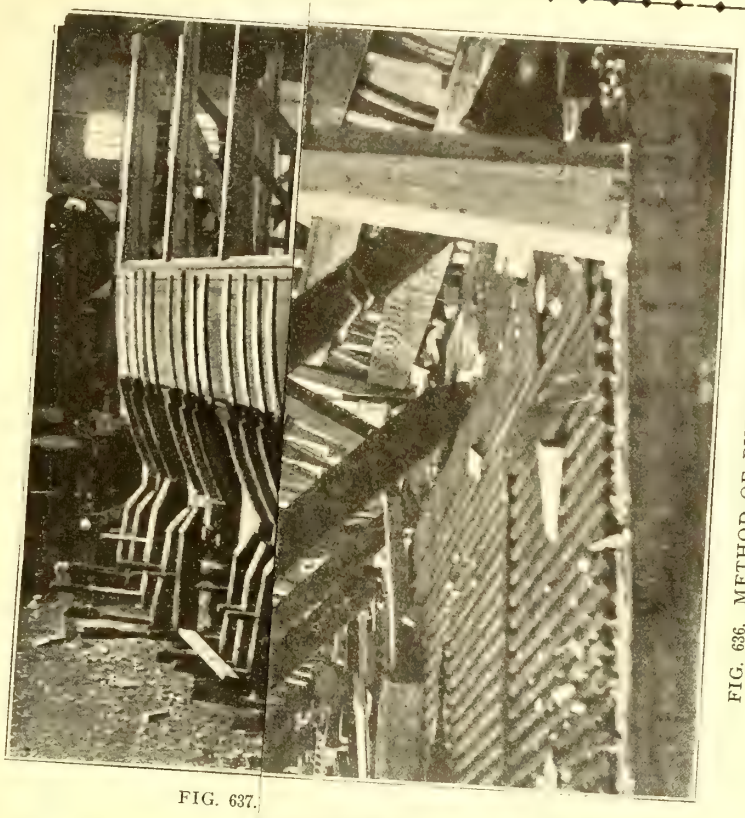


FIG. 636. METHOD OF PUTTING PANELS IN PLACE
(1895 WEDGING STRAINERS AGAINST PANELS)

FIG. 637.

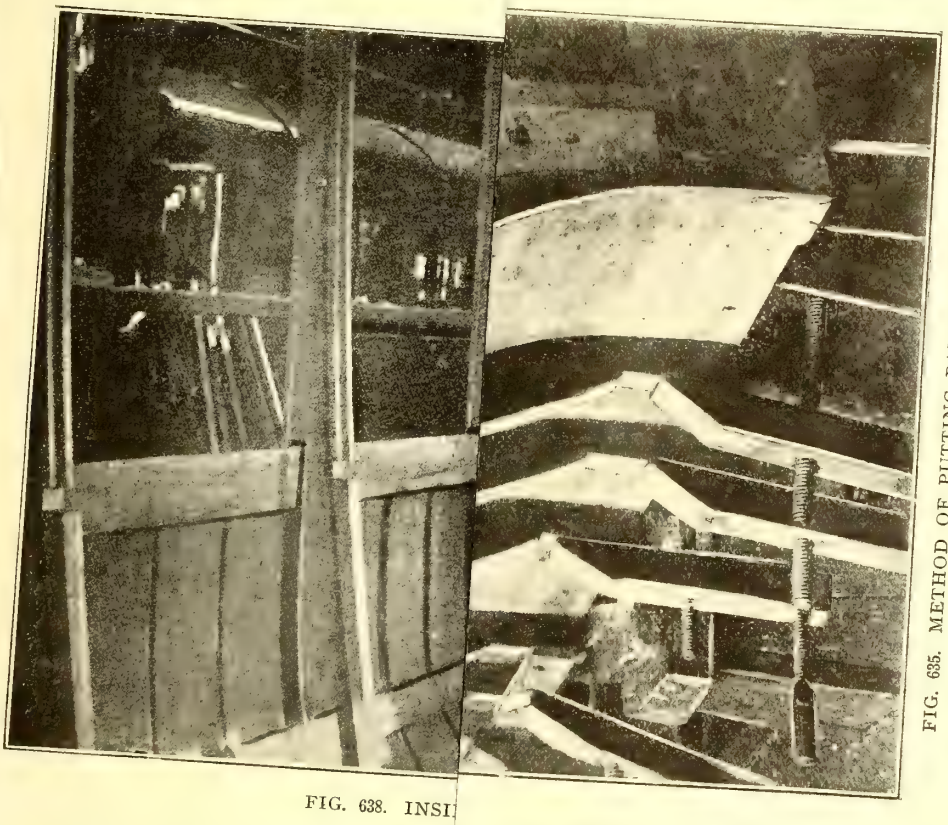


FIG. 635. METHOD OF PUTTING PANELS IN PLACE (1895)

FIG. 638. INSI

PLA (STEPHENSON PRACTICE)

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FIG. 626. INSIDE OF PANELS

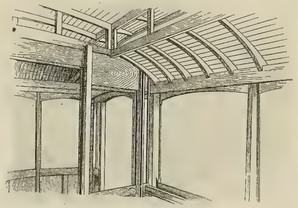


FIG. 627. INSIDE OF END

FIG. 631. INSIDE FRAMING OF ROOF. (J. G. BRILL CO., 1895)

FIG. 628. FRAMING OF SIDE AND END. (BOSTON CAR, 1896)

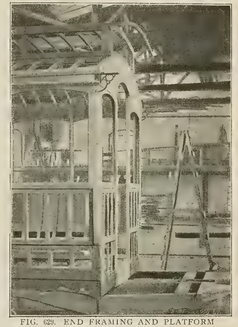


FIG. 629. END FRAMING AND PLATFORM (BOSTON CAR, 1896)

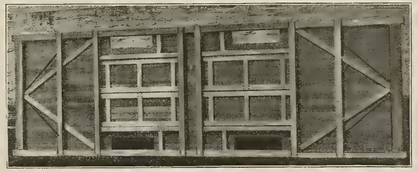


FIG. 632. FLOOR FRAMING. (UNDER SIDE, 1895)

FIG. 640. CORNER (IN THE WHITE)

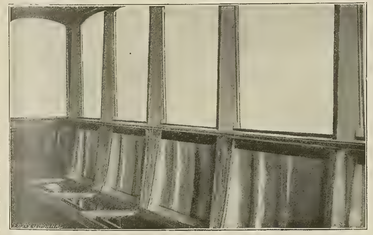


FIG. 630. INSIDE FRAMING. (BOSTON CAR, 1896)

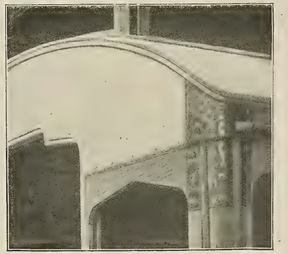


FIG. 635. CORNER PLATES. (J. G. BRILL CO., 1895)

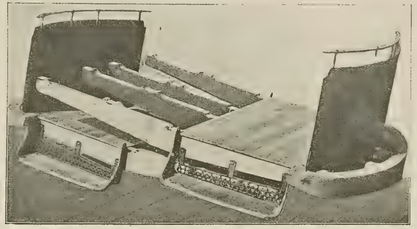


FIG. 634. CAR PLATFORMS (1895)

FIG. 637. METHOD OF PUTTING PANELS IN PLACE (1895)

FIG. 638. INSIDE FRAMING

FIG. 639. CORNER PLATES

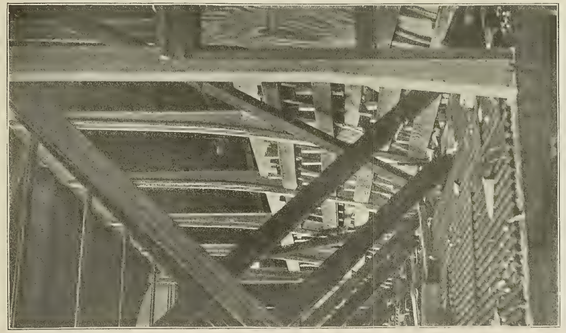


FIG. 636. METHOD OF PUTTING PANELS IN PLACE (1895 WEDGING STRAINERS AGAINST PANELS)

FIG. 636. METHOD OF PUTTING PANELS IN PLACE (1895)

PLATE XV. (FIGURES 626 TO 640)

VARYING PRACTICE IN STREET CAR BUILDING

ILLUSTRATING STREET CAR BUILDING (STEPHENSON PRACTICE)

....BY....

CHARLES HENRY DAVIS, C. E.

that which has been consumed is something that would appear, not in the balance sheet, but in the profit and loss statement, being, as before stated, one of the expenses. The question then is simply a method of taking out of the asset accounts from day to day, week to week, or month to month, according to the time schedule of the accounting system, that which is used. The asset account is to be credited with what is withdrawn, and the expense account is to be debited with the same amount.

* * * *

Here again, as in other cases, the association is lacking, at this time at least, in a skeleton of accounting principles to which it can subscribe, and a reference to which from time to time would show in what section or division of the balance sheet or profit and loss statement a given item belongs. The result of the discussion of Mr. Barnaby's paper was the appointment of a committee to prepare "a uniform set of blanks on stores, from the purchase to the inventory." It would be interesting to watch the work of this committee. To my mind the blanks proposed for standardization will vary materially at the hands of the different members of the committee, depending very much upon the theory underlying their use that each of the several members prefers. It is possible that some very interesting discussions will take place among the members of the committee before it really gets down to work as to the particular theory that shall prevail.

Franchise Tax Decision

On Nov. 14 the Appellate Division of the Supreme Court decided that a corporation affected by the franchise tax law may have the courts review its assessment as fixed by the State Tax Commission, notwithstanding the fact that such corporation does not file with that Commission a report regarding its condition, as required by law. The law provides that all corporations coming under the special franchise act shall file their first reports with the board before Nov. 1, 1899. The New York & Queens County Railway Company failed to file its report until April last, and then subsequently instituted proceedings to review the valuation placed on its property by the State Board. The Attorney-General, on behalf of the State Tax Commission, applied to Justice Herrick for a revocation of the writ upon this ground, and Justice Herrick decided against the company. The Attorney-General will, however, abide by the decision of the Appellate Division.

Chicago was visited by a fierce snow storm on Nov. 16, which seriously interrupted street and elevated railway traffic, and was responsible for two collisions, due to slippery rails.

Street Car Building

(Stephenson Practice)

BY CHARLES HENRY DAVIS, C. E

X.—Assembling—(Continued)

In the October issue of the STREET RAILWAY JOURNAL we finished the detailed description of the building of our two standard cars, namely, the Boston (closed) and the Brooklyn (open). Plate XIII. gives views of the four standard cars discussed, showing them completed and equipped as ready to operate:

Fig. 595.—*Brooklyn Closed Standard Car.*

Fig. 596.—*Metropolitan* (New York) *Open Standard* (single truck) *Car.*

Fig. 597.—*Boston Closed Standard Car.*

TABLE NO. 41.—DETAILS OF THE NUMBER OF PIECES IN STANDARD BOSTON CLOSED AND BROOKLYN OPEN CARS

GENERAL DIVISIONS OF CAR	STANDARD BOSTON CLOSED CAR						STANDARD BROOKLYN OPEN CAR					
	Number of Distinctive Pieces	Number of Pieces	Number of Bolts	Number of Screws (Approx.)	Number of Nails	Total of Columns (3)+(4)+(5)+(6)	Number of Distinctive Pieces	Number of Pieces	Number of Bolts	Number of Screws (Approx.)	Number of Nails	Total of Columns (9)+(10)+(11)+(12)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Bottoms	32	187	190	706	?	1,083+	27	96	158	584	?	838+
Sides and ends	71	746	4	2,150	?	2,900+	38	286	92	942	?	1,320+
Roofs and bonnets	62	622	216	1,622	?	2,460+	40	446	84	732	?	1,262+
Platforms	67	235	244	372	?	851+	60	189	310	322	?	821+
Cabinet work, trimmings, etc	144	1,335	None	3,700	?	5,038+	99	1,182	12	1,668	?	2,862+
Totals	376	3,128	654	8,550	?	12,332+	264	2,199	656	4,248	?	7,103+

Fig. 598.—*Brooklyn Open Standard Car.*

Table No. 41 groups the number of pieces of the Boston (closed) and Brooklyn (open), showing that the former has 112 more distinctive parts than the latter (equal to 42 per cent more), while the total number of pieces is 5229 + greater in the Boston (closed) than in the Brooklyn (open), which is equal to 73 per cent more. While the Boston (closed) has an excessive number of parts as compared with the best modern practice in closed cars, as exemplified in the Metropolitan (New York) standard double-truck car, for example, it nevertheless gives a fair idea of the relative greater complexity of a closed car over an open one.

Plates XIV. and XV. give some details of methods of construction (Figs. 599 to 620, inclusive, having been taken from "Carbuyer's Helper," issued by the Brownell Car Company, of St. Louis, while Figs. 621 to 641, inclusive, have been taken from various articles appearing from time to time in the STREET RAILWAY JOURNAL), as used in car building in various shops of the United States.

Allentown Company Absorbs New Lines

The Lehigh Valley Traction Company, of Allentown, Pa., has just completed negotiations for the purchase of the Allentown and Slatington Electric Railway and the Slate Belt Electric Railway. The Allentown & Slatington Electric Railway is 21 miles long, extending through the heart of Lehigh County, and the Slate Belt Electric Railway is 17 miles long, extending from Nazareth to Bangor, the slate belt region. It is proposed to run cars over the entire line, with Allentown as the center. The Lehigh Valley Traction Company's system now embraces 110 miles, and the purpose is to further extend the lines from Slatington to Mauch Chunk, a distance of 12 miles.

A New Car House at Newark, N. J.

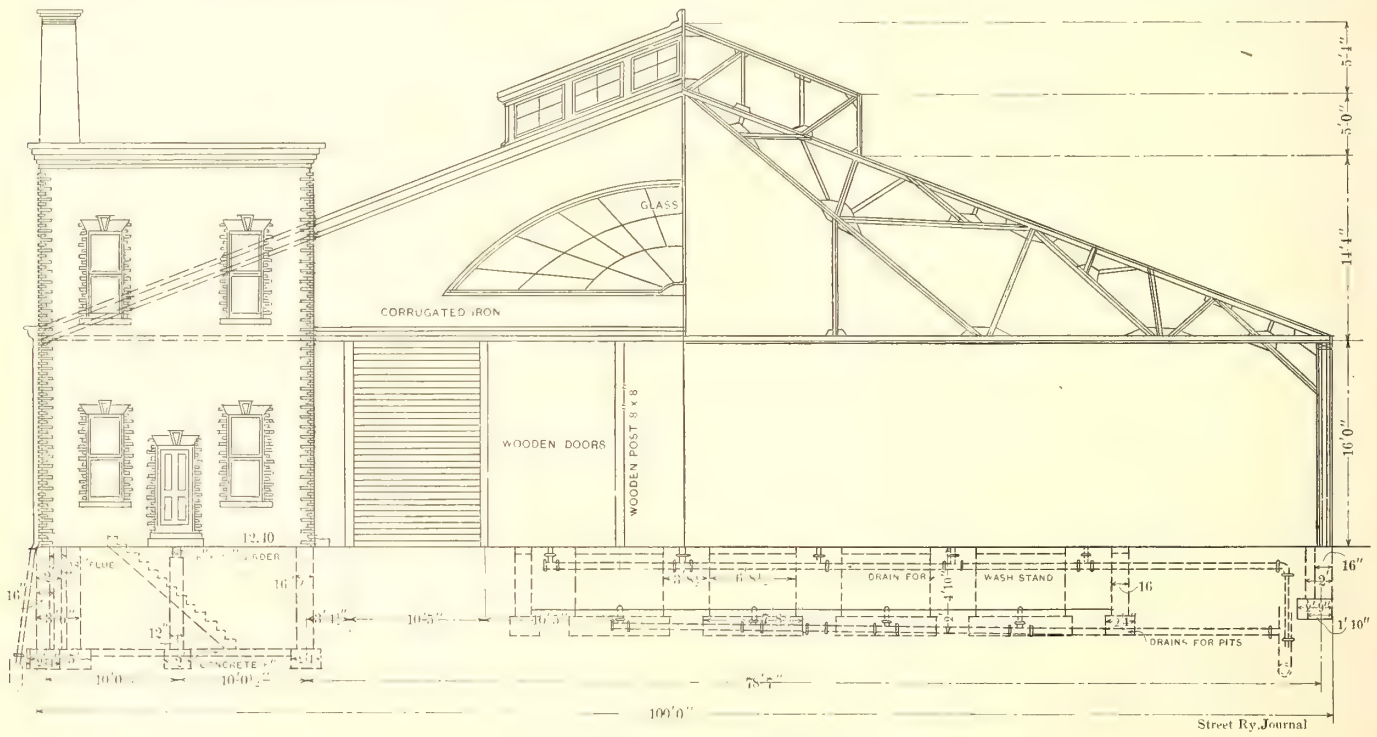
The North Jersey Street Railway Company has lately completed the car house illustrated on this page. The new building is situated at the corner of Frelinghuysen Avenue and Miller Street, the front being on Miller Street. The rear part of the site was formerly occupied by the old car house, which fact necessitated the employment of no little ingenuity in the building of the new structure, as the use of the old one had to be continued as long as possible during the construction. The front half was first completed and was immediately put in service for storing the cars while the old house was being removed and the rear portion built. This extended the work over a somewhat longer period than it would otherwise have taken, but had the advantage of not interfering materially with the service.

VIEW OF CAR HOUSE ENTRANCE

The two photographs reproduced herewith show the general exterior and interior appearance of the building, while the plan gives a good idea of the arrangement of tracks, pits, washstands, etc., as well as showing the disposal of the space allotted to the use of conductors and motormen. A study of this plan cannot fail to bring the fact prominently to view that the most careful thought has been given to all of the details and that the arrangement facilitates as much as possible the handling of cars.

The two-story office building at the corner extends upward above the main roof, and serves in a large measure to relieve the barn-like effect which appears in most structures of this kind. Together with the main walls, it is built of brick, the window-sills and other trimmings being of Indiana limestone. The roof is made of steel, covered with corrugated galvanized iron, which is guaranteed to last for ten years. The front gable is also covered with corrugated galvanized iron. The method of construction is shown in the cut of the front elevation. The fanlight is glazed with $\frac{1}{4}$-in. rough glass fastened in the framing made by the galvanized iron radiating bars of which it is constructed, and has a galvanized iron molded margin. Rough plate glass $\frac{3}{8}$ in. thick is used on the skylight. The vertical ventilating sashes are made of galvanized iron and $\frac{3}{8}$-in. glass, and are pivoted in the center, being operated by a crank and worm gear. The inside of the car house is painted white.

The floor is made of cement. Gratings are provided near the door on five of the tracks to make a washstand for cars. In the pits behind these gratings is installed a motor-driven Clayton air compressor, which furnishes a supply of air under a pressure of about 60 lbs., to be used in dusting the cars and blowing out the motors and controllers. This method of cleansing the equipment is found to be both expeditious and effective. In the pits are also the steam radiating pipes which will warm the building in winter. There are twenty coils, having a total radiating surface of 2300 sq. ft., and their presence will render the operations in the pits more pleasant during the cold weather than it



FRONT ELEVATION OF ENTRANCE

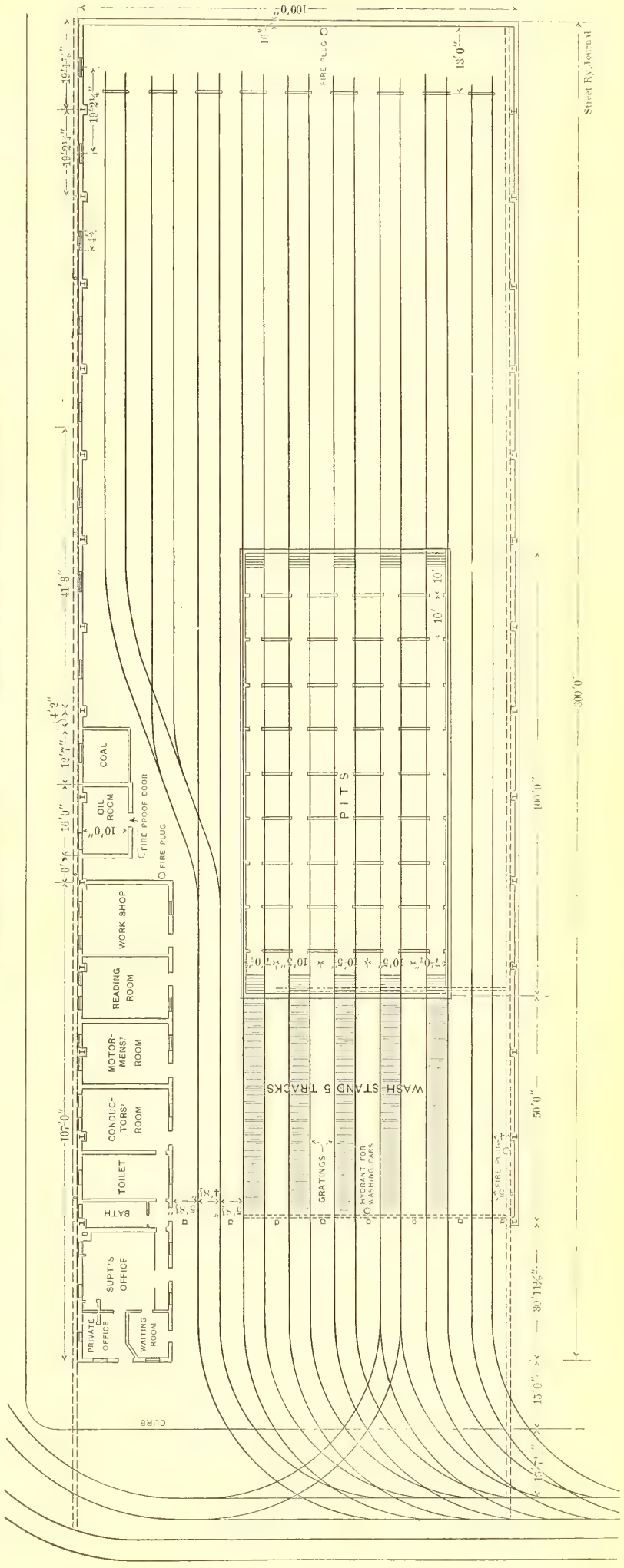
could otherwise be. The boilers which supply the steam for heating purposes are placed in the cellar of the office building. The plant consists of two Bundy boilers, installed in a room by themselves. The door of this room is held open by a fusible plug, which automatically causes it to close in case of fire. The heating is done by radiators in the offices, and the above mentioned coils in the car pits. There are also coils in the oil room, etc. The system has been designed so as to keep the temperature of the rooms, halls, etc., at 70 degs. F. when the outside temperature is at zero.

The comfort of the motormen and conductors has received careful attention. In the cellar lockers are provided, made of "expanded" metal, a kind of iron netting stamped out of a single sheet. Each man has a locker to himself, and, while insuring perfect ventilation, the netting permits inspection of the interior to be made without the necessity of opening the lockers. As shown by the plan,

INTERIOR OF CAR HOUSE

there are separate rooms for the motormen and conductors and a joint reading room. The walls of these rooms are provided with bulletin boards and blackboards, where time-tables, notices, etc., can be posted. The sanitary arrangements are all of the best, the men being allowed the use of the bath room upon application. Provision has been made on the second floor for the accommodation of the officers in charge of the car house, so that they can find comfortable quarters within the building itself. The front room is fitted up as a bedroom for their use. The lighting is done by incandescent lamps placed five in series between the trolley wire and ground, the building being also piped for gas, to be used in case of emergency.

The doors are made of horizontal wooden slats, rolling up on cylinders at their top. When open they permit the free use of all the tracks, and are entirely out of the way. On the inside and outside the trolley wire terminates at the doorway in an inverted, fan-shaped trough of copper, which assures the easy running of the cars through the doorway without fear of the trolley flying off. The oil room is provided with an automatic fire door similar to that used at the boiler room. The window is made of fireproof wired



glass. Fire plugs are provided around the building, in addition to the arrangements for washing the cars.

The car house was designed by A. W. Pratt, track master of the North Jersey Street Railway Company, and was erected under his personal supervision. It was through his courtesy that the photographs and drawings which illustrate this article were obtained, together with most of the accompanying data.

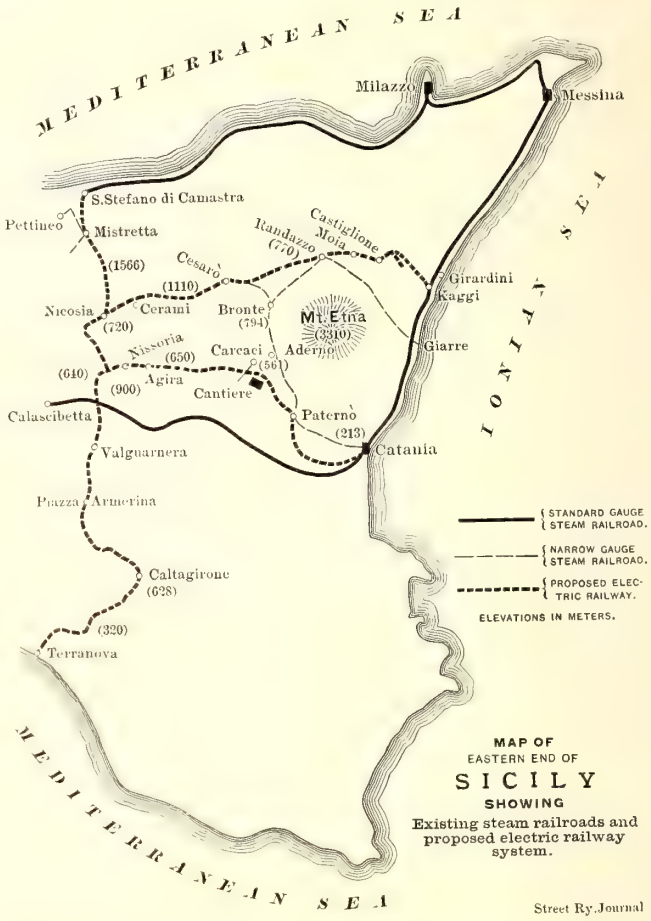
Electric Railway Possibilities in Sicily

BY CESARE PIO

The frequent changes in government, which the island of Sicily has endured for many years, operated for a long time to keep the grade of civilization of Sicilians very low, and, as a consequence, the industrial and financial conditions for many years have been far behind those of the Italian continent. The transportation facilities have felt the influence of this low grade of civilization, and while in Italy the steam railroads had a rapid growth all over the continent, in Sicily there has been, until during the last few years, a great need of steam railroads, as well as ordinary roads. Sicily should be the most prosperous country in Europe, on account of the great variety of its agricultural and horticultural products, as well as of the great number of sulphur mining centers; but on account of the great difficulties of communication and travel, the financial conditions of the island, as has been said, are very poor, indeed. The writer, who has traveled all through the island, can state that riding on the provincial and municipal roads is a most uncomfortable experience, and takes, besides, a very long time for any short trip, as the means of locomotion are still most primeval. The public horse carriages are of very poor construction, and the transportation of freight is carried on by means of primitive, two-wheel carts, supported on large wheels, which are often artistically painted. This kind of dray cannot carry in any case more than a short ton, so that the transportation of freight costs about 80 centimes (16 cents) per ton-mile. The railways are very few in number; they are mostly along the shores, and are owned by the Società Italiana per le Strade Ferrate della Sicilia, which does not give a good service.

As for the street railways in the main cities of the island, it may be said that, in spite of the size of these cities and the generally prosperous conditions of the population, no tramway of any description has been built up to now, so that electric traction is now being applied to some of the Sicilian towns without involving the transformation of horse lines into electric, as has happened in the most of the Italian cities on the continent. The existing transportation facilities in the streets of Sicilian towns are public carriages, which charge from 50 centimes to 100 centimes (10 cents to 20 cents) for a short ride within the city. For going outside the city a special contract must be made with the driver, and as the rule it is quite expensive to go beyond the city limits. Taken altogether, the outlook for electric traction enterprises is exceedingly good in Sicily. This has been recognized by a number of foreign electrical manufacturing companies, who have opened offices and agencies in the island for construction work in electric railway enterprises.

The Schuckert Electric Company, of Nuremburg, was the first to establish an important office in Palermo. In that city the same company installed a complete plant for lighting and electric traction. Later the Allgemeine Elektricitäts-Gesellschaft, of Berlin, opened in Palermo an agency for the same purpose. The Heilos E. A. G., from Cöln (Ehrenfeld), Germany, established in Catania, about the end of last year, a construction office for installing a 2000-hp central station for traction purposes. The same company was granted a franchise for sixty years for the operation of a street railway system in the city and vicinity of Catania. In Trapani, on the west shore of the island, a French company was granted, six months ago, a franchise for an interurban railway, running from Trapani to Monte S. Giuliano and to Paparella. In Syracuse on the east coast, franchises for a street railway were also granted about two months ago. In Messina the steam road running from the harbor to Faro (lighthouse), and for about 7 miles on the beautiful shore of the Stretto of Messina, will be soon transformed to an electric road by a Belgium company. Many other cities are in need of a good electric railway system, and there is no doubt that all these lines will prove profitable investments.



Among the roads that the writer believes will pay fairly well is the Giardini-Taormina Railway, situated between Catania and Messina, on the east coast. The number of visitors coming to inspect the interesting relics and ruins of the old Greek colony situated there is enormous. The climate of Taormina is healthful, and many foreigners spend the winter there for the benefit of their health. At present the steam railroad trains stop at Giardini, a small village situated at the foot of Taormina Mountains. There are 3 miles to traverse before the traveler can reach Taormina City, which is situated about 750 ft. above the sea level. At present the only conveyances for this distance are the ordinary Sicilian horse carriages, which are very slow and very far from comfortable. Besides, the fares are very high, and there is no doubt that an electric line running from Giardini up to Taormina, and thence through all of that delightful locality, would pay fairly well.

The State Railroad Commission has just had presented to it an extended scheme for electric traction, which will no doubt increase, when operated, the prosperity of the island. This project calls for the construction of a large

electric railway, 200 miles long, and connecting the east, north and south coasts of Sicily. The map herewith, for which the writer is indebted to the secretary of the State Railroad Commission, shows, in dotted lines, the projected electric railway. The full lines indicate the present standard gage (1.44 m) steam railroad. The line drawn with dashes, running around Mt. Etna, from Catania to Giarre, is a narrow gage steam road, which has been in operation for only a few years, and is owned by an English company. This railroad connects all the farming districts around Etna, Paternò, Biancavilla, Aderno, Bronte and Randazzo, with the harbors of Catania and Giarre. The proposed electric line connects the two shores and harbors with the center of Sicily, which is now isolated.

The government will probably give this railway a subsidy of $1,500 per mile. Water power will be utilized at two points, one of which can furnish 4000 hp, and the other 8000 hp. The generating apparatus will be direct-connected to the turbines, and will consist of two 300-kw alternating-current machines, generating three-phase current at 400 volts, 25 cycles. This will be stepped up to 12,000 volts. The high-potential current will be sent to two sub-stations, situated at Valguarnera and Cesarò. In each of the two sub-stations there will be a single bank of three step-down transformers, provided with a special high-potential switchboard, and two rotary converters, giving direct current at 550 volts, which will feed the trolley line.

The Circumenea Railroad Company is very much interested in this project, and will probably change its 70 miles of steam roads to electric. Indications also point to the possible consolidation later of the Catania Street Railway Company with the operating company of the large electric railway system described above.

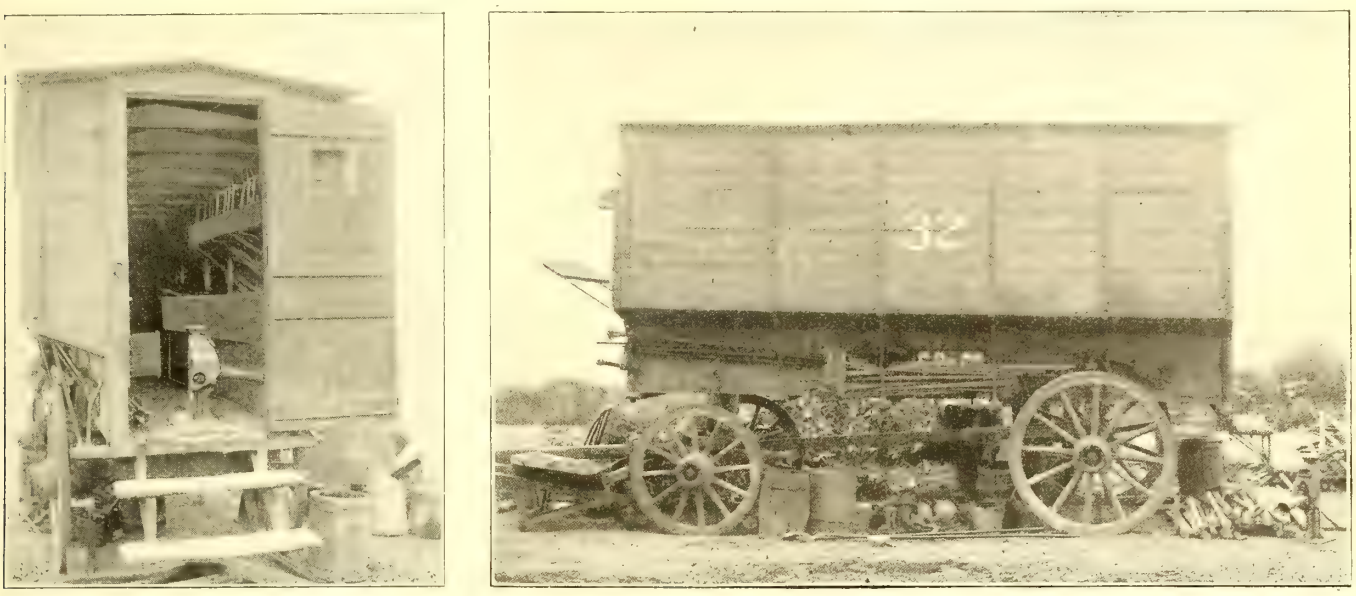
The report of the Secretary of State for Ohio regarding the new incorporations, etc., for the year ending Nov. 1, shows that the value of electrical properties in the State has increased beyond all precedent. The number of new street railway companies and consolidations numbered thirty-five; the capital involved was $10,352,000, and the increased capitalization $8,160,000. Fourteen electric light and power companies were consolidated; the capital involved was $930,500, and the increased capitalization $254,000. Sixty-nine telegraph and telephone companies were consolidated; the capital involved was $1,388,999, and the increased capitalization $4,442,000.

Track Tool Wagon

The accompanying illustrations are views of a very strong and convenient wagon for storing and transporting track tools and supplies during construction and repair work. The wagons are of a type that are employed on the lines of the Chicago City Railway and were designed and built in the company's repair shops. Quite a number have been employed by this company for some years.

The frame work and sheathing are of heavy oak timbers and plank, rendering the wagon strong and safe so that it can be left on the work at night without fear that it will be broken into and tools removed.

As will be noted, the entrance is from the back end, and this entrance is closed by a strong door which can be locked. The interior walls of the body are provided with shelves and bins for the storing of bolts, spikes and other small parts as well as the shovels, picks, jacks and lamps which are used by the workmen. Provision is made on the roof for carrying the poles of the electric drop lights which are employed on night work, and which have been previously described in these columns. The braces which support the flaring portion of the body on each side also provide a place for carrying the brooms, track brushes and tamping irons. The dimensions are about the same as ordinary van wagons and the vehicle is not so heavy but that it can be hauled about and shifted by an ordinary team of horses. Some of these wagons were rebuilt from old grain wagons, while others were built from new designs as above noted.



END AND SIDE VIEWS OF TRACK TOOL WAGON

Commutator and Bearing Wear at Council Bluffs

The Omaha & Council Bluffs Railway & Bridge Company, operating the electric line between Council Bluffs and Omaha, has met with some motor maintenance difficulties which have been successfully overcome, and the results will be of interest to other roads having similar troubles, though the points are not entirely new. Three years ago the company bought some G. E. 57 motors to run under its long interurban cars. These motors gave much trouble from commutator wear, the sparking being excessive, and it being necessary sometimes to turn down a commutator as much as $\frac{3}{8}$ ins. After a time it was found this was due entirely to too hard mica between the commutator segments. It is now the practice to groove out the mica between the

segments to a distance of 1-32 in. or 1-64 in. below the surface of the commutator. The commutators now run without any attention whatever except a turning down every three months, when an armature is out to have bearings renewed. The cost of such turning down in this shop is given by Master Mechanic Tarkington as 50 cents to 60 cents. No treatment is given the brushes, they are simply renewed as fast as they wear out. These motors average 140 miles a day, and the original commutators are still on the road. The grooving out of the mica is done by putting the armature in a lathe, fastening it so that it cannot turn, and putting the grooving tool in the tool post of the lathe, so that when the tool post is worked back and forth parallel with the axle by hand the mica can be grooved out from between the segments. This affords a cheap and rapid method of doing this work. When the motor is run the grooves do not clog with carbon from the brushes, as would be supposed, and the effect of the grooves seems to be nothing but beneficial.

In renewing armature bearings it has been found that better results are secured by boring out the freshly babbitted shells in a lathe to fit accurately the armature journal they go on, rather than by casting the shell around a standard mandrel, which may not be the exact size of the armature journal owing to wear on the journal. The shells are poured over a core, and then bored out in a lathe. A special chuck, which is clamped over the whole length of the shell, and which requires no special centering, is used for holding the shell while it is being bored out. As a small amount of play in an armature, when new, reduces the clearance so materially (in practice it will sometimes reduce it one-half), and as this reduction of clearance so reduces the length of time an armature can safely be run as to call for more frequent renewals, Mr. Tarkington considers that the extra work of boring out shells is fully paid for in assurance of longer life and safety from armatures hitting pole pieces.

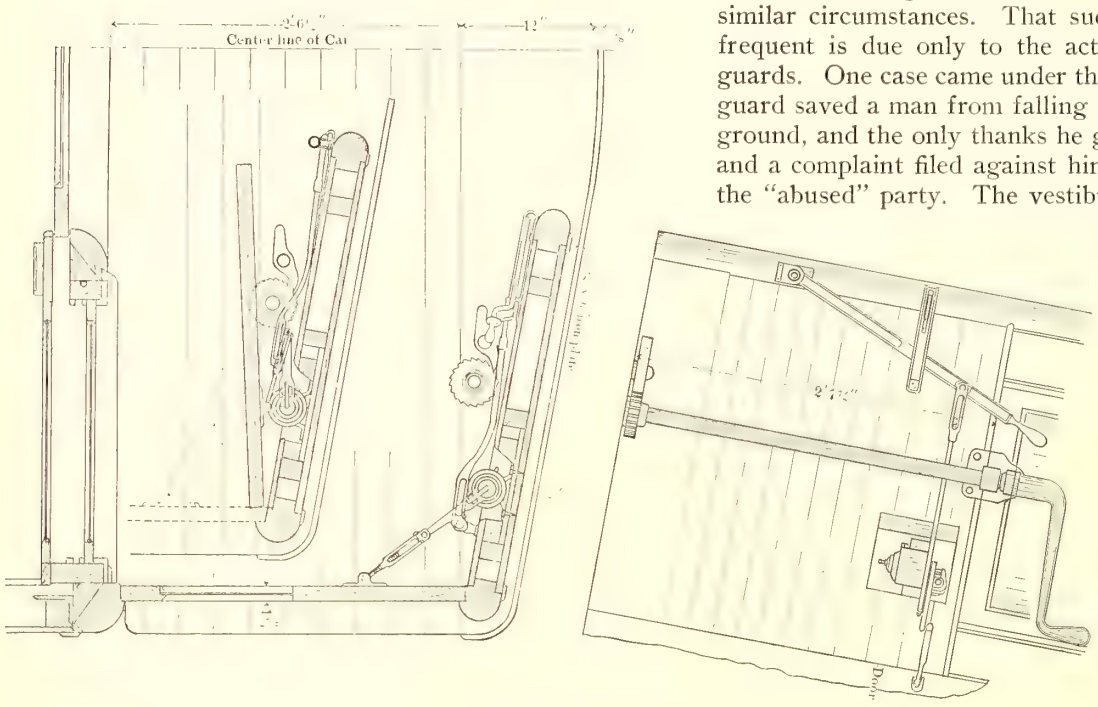


FIG. 1.—NEW TYPE OF GATE

The Cincinnati Street Railway Company has been granted a franchise for the extension of its Warsaw Avenue line to connect with its Elberon Avenue line at the latter's terminus at St. Joseph's Cemetery, thus forming a belt line.

New Type of Gate for the Northwestern Elevated, Chicago

In the equipment of the Northwestern Elevated Railroad, of Chicago, a departure from the usual type of elevated railway gate was made on some of the cars. The change appears to be for the better, as far as the danger of accidents is concerned. The gate, instead of being an iron framework, about 3½ ft. high, is a wooden vestibule door, with plate glass window, reaching clear to the hood of the car, and making the cars practically vestibuled. Each year there

FIG. 2.—CAR OF NORTHWESTERN ELEVATED RAILWAY

are usually a number of accidents on an elevated road, due to efforts of passengers to board the train after it has started and the gates have been closed, or to get off under similar circumstances. That such accidents are not more frequent is due only to the activity and strength of the guards. One case came under the writer's notice where the guard saved a man from falling from the train clear to the ground, and the only thanks he got was a torrent of abuse and a complaint filed against him at the general offices by the "abused" party. The vestibule-door form of gate entirely put an end to accidents of this kind, and also to the exceedingly annoying complaints and quarrels with people who think they should be allowed to jump over the usual type of gate. When the gate is shut that settles the question beyond any dispute or foolish attempt. These doors are 2 ft. 6½ ins. wide, and swing back against the front wall of the vestibule. The mechanism for swinging the door open or shut is very simple, and is shown in the accompanying illustration, Fig. 1. As will be seen, a straight hand lever is used instead of a crank. Fig. 2 shows one of the cars as it appears with the doors closed. The cars are Pullman make.

A New Ohio Road

The contracts for constructing the Dayton, Tippecanoe & Troy Interurban Railway have been awarded, and the line is now under construction. The line will extend from Dayton to Piqua, and among the towns through which it will pass are Troy, Piqua, Tippecanoe, West Carrollton, Phoneton, Brant, New Carlisle, Trademore, Vandalia, Fishburg, Hooksville and Dayton. The power house, car house, shops, etc., are to be located at Tippecanoe. The Westinghouse Company has been awarded the contract for the electrical equipment of the line. The Carnegie Steel Company secured the contract for the rails, and the New Castle Bridge Company was the successful bidder for the bridge work.

Suggestions on How to Make Non-Paying Roads Pay—I.

BY H. S. COOPER

After from five years to ten years of strenuous effort and unlimited expenditure, it seems pitiful that nine-tenths of the urban street railways of the United States do not pay dividends, and over three-fifths of them, excluding a few in the larger cities, are not actually earning their fixed charges and depreciation. Their bond and stockholders are in the condition of the farmer who had hold of the mad bull's tail in the pasture, "It's the devil to hold on, but it's hell to let go!" That cry, "Give! Give!" rings continually in their ears, and good money is thrown after bad in the hope that "something will turn up" to better matters, to change the outgo to income.

With many of these the hope is hopeless, for facts and conditions are against their being a success in their location; their only resource is the receiver or the second-hand dealer and a credit entry to profit and loss, and the sooner such entry is made the better it will be for the owners.

There are others which are not legitimate commercial enterprises; conceived in promotion and born in stock jobbery, they have subserved their ends when the last certificate or bond is unloaded, and the sheriff and the junk man, acting as minister and undertaker, are the logical outcome. Others of this class are those built solely or principally to back up some land scheme, to connect somebody's "addition" to the city, to make good one claim of the real estate agent, "Within two minutes' walk of the street cars." These sometimes contain elements of success, but are not of themselves legitimate operating enterprises, as they depend on fortuitous circumstances for their success, and are mostly a species of lottery.

There are, however, many roads that were built in good faith, and are trying to be operated as legitimate business enterprises, where, by a change of policy, management, route or schedule the scale could be tipped the other way; where economies could be practiced that would—without lessening net earnings or increasing operating expenses or depreciation—transfer a balance to the other side of the ledger; where an expenditure in certain directions would result in a decrease of operating expenses or an increase of receipts much greater than the expenditure, and there are others where all or a large part of the above might have to be applied.

No hard-and-fast rule or rules can be made for the successful and remunerative operation of all street railways, no matter how similar many of them may seem. No two properties are so exactly alike in their condition and conditions that exactly similar treatment will bring similar results. Local conditions and characteristics vary so infinitely that an exact and careful study of each case, on the ground, *must* be had before a correct diagnosis can be made and a complete remedy prescribed, for the successful rehabilitation of such properties is not a matter of rule or theory, but a practical application of the knowledge and experience obtained under all possible varying conditions.

In these articles it is proposed to give as suggestions those things which have been found of practical value in obtaining better results from many non-paying properties—properties of all conditions and classes, and situated in towns and cities of all kinds and locations. It is not thought to make these articles a "Stock-and-bondholder's-Vademecum," or an "Every-street-railway-owner-his-own-reorganizer." The only thorough and complete plan for the betterment of any street railway property must be made by a competent and experienced man, after having thoroughly, conscientiously and understandingly gone into all the conditions which affect that property.

One of the first and most important factors in the success or non-success of any road, is the *personal element*—the employees; and chief among them is the manager or superintendent, the operating head—whatever his title may be. Of him there should be but one, and he should be as good a one as it is possible to afford.

One of the most successful of employers was once asked the secret of his success in always being able to surround himself with efficient, trustworthy and permanent subordinates, and his answer was: "I get good men, tell them what I want, let them alone, watch the results, and if they are good, I keep the men!" And that about tells the whole story in five short and pithy chapters. Let us elaborate them a little.

Chapter I. "Get good men." Now, good men in any business cost more than poor ones, and in the street railway business this is especially the case, as the necessary qualifications of the operating head of a small or medium-sized road are more numerous and complex than in any other business. While it is not needful that he be an E. E. or an M. E., it is needful that he have a fair theoretical and practical knowledge of both those branches, or, human nature being human nature in street railways, as elsewhere, his subordinates and others may take advantage of his ignorance, to the detriment and expense of the company. While it is not necessary that he be a practical line man, track man, winder, painter, carpenter, machinist or blacksmith, he should have had enough practical experience of all these branches to enable him to judge the results of the expenditure of labor and material in them. He must be a thorough disciplinarian, and must still be able to win and retain the liking and respect of all his subordinates. He must be accountant enough to obtain from any and all sources such data as he needs, and, where it is necessary, to originate the forms and methods necessary to do it; and he must be able to collect, collate, integrate and understandingly apply such data when obtained. He must have a pleasing address, imperturbable good nature, endless tact, an abundant knowledge of human nature, and must be "as wise as a serpent and as harmless as a dove," for he has municipalities and municipal officers, politicians, lawyers, doctors, editors, reporters, ministers, professors, his executive committee and local owners, all sorts and kinds of kickers, cranks, fools and knaves, and last—but not least—the ladies to deal with, to convince, to foil, to please, to pacify, to placate! He must be pliable where it is necessary, and no principle is involved, and he must be firm as a rock when right or duty requires it. He must have no "string to him," but must be free from any affiliations or influences that will lessen or limit his usefulness to his employer, the company. Finally, he must be honest, truthful, sober, industrious, untiring, cool-headed and a pusher—both of himself and others!

With such a list of necessary qualifications, the lack of any one of which may make the difference between success and failure for himself and his company, is it any wonder that, at the salaries generally paid by small and medium-sized roads, their operating heads are not what they ought to be? Leaving out the technical knowledge, a man who has the other qualifications above enumerated will make a success of any business under possible circumstances, and if such a man—with the additional technical knowledge—is compelled to take the position of operating head of the ordinary small or medium-sized street railway, at the salary and under the conditions usually attendant, is it any wonder if he uses such a position merely as a stepping-stone to something better?

Not that all high-priced men are good, or all low-priced

men are poor, but, as a rule, brains, combined with energy, honesty and good judgment, have a fairly steady comparative market value, and, other things being equal, a man who will work in a certain position for $1,000 per year will not be as valuable a man in that position as one who will not undertake it at less than $2,000; and the chances are, in a complex business like the management of a street railway, that the higher priced man can show previous better results than the other, and that he will save or earn for his employer much more than the excess paid him.

Another mistake, in line with the employment of a cheap head, is that of employing a cheap "practical" operating superintendent to "look after" that portion of the operating, and then think that the road may be successfully "run"—as a side issue—by some doctor, lawyer, banker, college professor, or any other "butcher, baker or candle-stick maker" who may be a local owner or the relative, friend, favorite or representative of an owner. Because he has made a success of a totally different business—and very often because he has made a failure of one—because he is known and liked by every one in the town, because he has a pull in this, that or the other direction, and very often simply because he is an owner or a representative of one, he is put on to "manage" the road. Without an ounce of training in one of the most complicated of businesses, with all his ideas, feelings and prejudices fresh from the passenger side of the business, hampered by his ignorance of the mechanical and practical side of the operating, and made mischievously suspicious by that ignorance, handicapped by his previous business and social relations with the patrons of the road, is it any wonder that under such a management (?) the road gathers debts and depreciation, that it has either a quick fever or a slow decline, that it jumps into the arms of a receiver or leads an anæmic existence that is liable to terminate from the slightest cause?

It is true that there are a number of successful roads that are apparently managed by doctors, bankers, etc., but in many cases of this kind another power will be found behind the throne, a subordinate or subordinates, "railway men" by training, who alone are responsible for the success, but whose work is successfully covered and appropriated by the big man. The exceptions to these cases are the exceptions that prove the former rule. If the street railway business were not a business by itself, as much so as banking, law, medicine, teaching or selling or buying goods, then it might be possible for Tom, Dick or Harry to successfully "run it" without previous experience, but it is a business *sui generis,* and, therefore, needs as head a man who not only has an aptitude for it, but also a thorough training and a previous successful experience in it.

Therefore, if your road is not paying, or is not properly paying, if it is "going down hill," and the cause is not plainly visible, look to your operating head, or the place where it ought to be. If you have two or three or a dozen, cut them all off but one, and have that a good one; if you have none, get one; if you have only half a one, get a whole one; if you have a poor one, get a good one—you must have a head, and he must be a "good man!"

"But we cannot afford such a man."

"How do you know, have you ever tried one?"

"No, but we are just paying expenses now, and if we go paying a big salary, we won't be able to pay expenses at all!"

"Now, look here! Suppose you pay a competent man a thousand dollars a year more than your present mismanagement costs you, and he *saves* you a thousand dollars a year (that is only $2.75 per day!) in one direction, and makes you another thousand (which is also $2.75 per day!) in another, will it not have paid you?"

"Yes—but there is not any chance to do that here. We know this road and the people better than any stranger, and there is not another cent to be made or saved out of it."

"Well, if that is the case, then your road has absolutely no reason for existing, and the sooner you pull it up by the roots and sell it to the junk man the better you will be off. But in all probability it is not the case. Do you mean to say that you are so thoroughly acquainted—not only with your road and people, but with all that is known of the possibilities and resources of street railroading—as to affirm that nothing can be done by anyone to decrease your expenses or increase your earnings?"

"Oh, well, we wouldn't go so far as to say that."

"All right. Now, your road is not paying dividends, is it?"

"No."

"All you can do to scrape up enough to pay bond interest, isn't it?"

"Just about."

"And how about depreciation?"

"Oh, we keep the repairs up, all right."

"Great Scott! *That's* operating expenses! What I asked about was de-pre-ci-a-tion! How old is the road?"

"Five years."

"And the track?"

"The same."

"And the cars, and equipments, and the line, and the buildings, and the generating machinery?"

"About the same, but in the last two years we've put in a lot of new ties and poles, and bought some nice second-hand cars, and fixed the trolley wire the whole length of the road!"

"Are you insured against accidents?"

"No, it costs us too much to do that. Besides, we run so carefully that we never have any accidents to amount to anything."

"H'm! Any paving or repaving to be done soon along your line?"

"Well, there's some talk of it, but we can arrange *that*—we stand in all right with the city!"

"All right! Now—on your own showing—you are barely earning your operating expenses and fixed charges. Your property is worth less than half what it was in the beginning, and is cutting out 10 cents more on the dollar of its value every year, and in five years more it won't have any value at all, except as junk, and in three years more you won't be able to run at all. You are liable at any minute to have an accident that will put you into the hands of the sheriff or the receiver, some turn of politics or public opinion may swamp you with a paving bill, and yet you neglect the only chance that is left. You have shown that you have pretty nearly every disease that street railways are heir to, and yet you won't call in a specialist, pay him a reasonable fee for a reasonable time, and get positive results—one way or the other."

Now, this is not an isolated or an exaggerated case; within sixty days four similar situations have been brought to the notice of the writer.

Chapter II. "Tell him what you want." Have a plain and full understanding as to his duties, his authority, his responsibilities, his limitations. Be frank with him as to the exact condition of the property in every respect. Explain to him fully the policy, aims and desires of the owners. Give him full and unprejudiced information as to any points that may be of use to him in his position. Make him second only to the board of directors, or their empowered representative, in all matters pertaining to the policy of the company or any matter that affects the property, its charter, its franchises or its standing in law, and in all matters of operating make him the superior of that

board or representative. If he is not worthy of this confidence and this trust he is not the man you want!

Chapter III. "Let him alone." Don't meddle with him because his methods are not yours. Keep your hands off him, and keep other's hands off him. Protect his authority both from yourself and from others, no matter how great the temptation. Always refer to him all matters that come under his authority. Never criticise him adversely to, or before, others, outside of the owners. If you have suggestions to make, be sure first that they are good, feasible and seasonable, and if so, go to him and give them to him quietly as suggestions. If you receive complaints or criticisms that are serious, and cannot be referred to him, be fair and just, lay them before him, giving him your authority, and hearing his side of the matter fully. Don't worry yourself or him in regard to his methods as long as they are clean. No two people do the same thing the same way. What you are after is results, leave the methods to him, as long as they are only a "matter of opinion."

Chapter IV. "Watch the results." Look for them only within a reasonable time, taking into full consideration what is against them and the obtaining of them. Don't look for instantaneous results nor that all shall come together; "make haste slowly" is the motto of a new executive, and the easy handling of a new broom raises least dust.

Watch the operation; see if the employees are more alert and attentive to duty, if the cars are cleaner and run more closely to schedule, if there are less breakdowns, detentions and delays, if the public, as a whole, is being better served and satisfied. Watch the property; see if it appreciates, if the cars are less noisy, if the track is less bumpy, if the overhead work looks less like a Monday morning clothesline, if the power station and car house are neater, cleaner and more orderly, if everything shows signs of "walking up" instead of "running down." Watch the accounts; see if the income is greater or less than last year, at the same time taking into consideration all attendant circumstances and conditions, see if the operating expenses are greater or less than last year, and in what department and why, note the proportionate increase or decrease of your accounts payable, bills payable and bank accounts, analyze and integrate all the returns carefully, giving full consideration to all affecting conditions. Note especially your material or supply accounts and the condition and value of the stock room supplies.

All the above items, if intelligently read and considered, will give you the material results, and if, within a reasonable time, they do not average favorably, then it is your right to lay the matter before the new man, and ask his explanation. Put it to him in a quiet, business way, hear fully what he has to say, insist on a careful explanation of all points not plain to you, judge his explanation on straight business principles the same as you would in your own business, giving him credit for results to be attained as shown by his previous experiences. No honest and competent man will object to such an inquiry so conducted, after he has had a reasonable time in which to show his ability and the results from it. What drives him half crazy and takes the heart out of him is the petty, personal and unreasonable complaints and criticisms, the usurping of and meddling with his authority, and the half-hearted semi-cooperation of his officers and owners.

Chapter V. "If the results are good, keep him." Don't be in a hurry to change him, even if the results are not up to your expectations, so long as they are better than they were before he came. Give him an unreasonable length of time to come up to your expectations, as they probably were unreasonable. Besides that, in such cases as yours, the results are generally in the form of an arithmetical progression, with a very small first term. It always takes some time for a new man to get his bearings, and his best work will not come until he has all matters and people at his finger's ends. Besides that, a new man is expensive at first, no matter how economical he may be. He is getting his bearings at the company's expense, and the full round of the year with the different conditions of each season must roll by before his local education is complete. He will, of necessity, have his own particular methods, which will necessitate an investment on the part of the company that would be lost under the different methods of a succeeding—even if better—man. Therefore, it is wiser and generally better economy on the part of the owner if the results obtained by a new man are good, and better, as time passes, to keep him until they are fully satisfied that they should do better. If, however, the new man gives first-class results, do everything possible and reasonable to retain him. Don't think that the salary check pays everything, let him feel with words and acts that his efforts in your behalf are appreciated. Commend where commendation can possibly be given, don't think that merited praise will cause the "big head"; that is an exploded theory. Willing, cheerful effort reaches twice as far as that done perfunctorily, and nothing tends to it more than a knowledge of its appreciation. Do not stop at words, let your appreciation show itself in a material form, an extra vacation with a little extra check to enable it to be fully enjoyed, a slight and unasked increase in salary, a present at Christmas or New Year's, or at the end of the fiscal year, will generally bring usurious interest. Remember, also, that such a man has aspirations for the future; that, as a rule, he will grow faster than the property, and that a sense of ownership or partnership is the highest and most continuous spur to effort; therefore—when you are assured that he is the man that you want, and before his salary reaches the limit—you can commercially afford to give him a personal interest in the property, some stock or some scrip, or the opportunity to purchase some at low prices and easy terms, a percentage on the net returns or the dividends, something that will give him a participation in the results obtained by his own efforts, and that will increase with the results. It will be a good investment, it makes and keeps a satisfied man!

In regard to the other employees, your share in their improvement will be more administrative than executive, for if the new man is the "good man," their efficiency will be mainly in his hands. You can, however, co-operate with him in all efforts for their benefit; in fact you must do so unless you wish to make them partisans for him instead of allegiants to the company. Remember that injustice is felt and resented sooner and deeper than illiberality by the rank and file of the employees, and whether it is directed toward them or to a liked and honored official; and that very often a small concession, intervention, commendation or reward on the part of the company is a strong incentive to loyalty and a discouragement to partisanship and dissatisfaction. *(To be continued.)*

Opening of the Albany & Hudson

The line of the Albany & Hudson Railway & Power Company was officially opened on Thursday, Nov. 22. A special train left New York in the morning with a large contingent of capitalists and railway and supply men, which took the party to Hudson. An inspection of the entire road was then made, the guests being carried to Rensselaer by the company's large and elegant cars at express speed, and returning at a more leisurely rate, when opportunities were afforded to visit the sub-stations, car houses and the main combination hydraulic and steam power plant at Stuyvesant Falls.

LEGAL NOTES AND COMMENTS*

Edited by J. Aspinwall Hodge, Jr., of the New York Bar.

CHARTERS, ORDINANCES, FRANCHISES, ETC.

CALIFORNIA.—Tracks—Intersection—Use by Two Companies. In 1897 defendant constructed and has since maintained a street railway in a city, under a franchise from it. Civ. Code, sec. 499, provides that "two lines of street railway operated under different managements may be permitted to use the same street, each paying an equal portion for the construction of the tracks and appurtenances used by such railways jointly." Held, that plaintiff, having a like franchise from defendant, is entitled to intersect defendant's tracks and operate cars thereon jointly with defendant, upon payment to the latter of one-half of the value of the tracks and appurtenances at the time plaintiff is permitted to make use of them.—(Hook vs. Los Angeles Ry. Co., 61 Pac. Rep., 912.)

CALIFORNIA. — Construction—Contracts—Consideration—Estoppel—Discharge—Notice.

1. Plaintiff owned and operated a street railway on M Street, and defendant obtained a franchise for a street railway on T Street, which did not cross M Street directly, but entered it from the east, and followed it for a short distance, and branched off to the west. Defendant agreed, in writing, that, if plaintiff would grant the right to use its track on M Street from the entering to the departure of T Street, defendant would reconstruct that part of plaintiff's line and equip it for use as an electric line. Four months later they executed a supplemental agreement, which provided that, in the event plaintiff elected to spread its tracks to a greater distance than 8½ ft. from center to center, defendant would pay all costs incident to such change. Held, that the supplemental agreement was void for want of consideration, since it was not an alteration of the original contract, but in addition to it of a new and onerous burden on defendant.

2. Where, after plaintiff and defendant had executed a written agreement, they entered into a second one, which was designated as supplemental to and explanatory of the first, the fact that it was so designated did not estop defendant from showing that the supplemental agreement was not a part of the original, and that it was without consideration.

3. Where, after plaintiff and defendant had executed a written agreement, they entered into a second, which was designated as supplemental to and explanatory of the first, the fact that defendant notified plaintiff that he would not be bound by the supplemental agreement did not discharge him from his obligation under it, since the party in fault cannot discharge a contract by repudiating it.—(Main St. & A. P. R. Co. vs. Los Angeles Traction Co., 61 Pac. Rep., 937.)

GEORGIA.—City Improvements—Paving—Liability of Street Railway.

1. The act of Oct. 10, 1891 (Acts 1890-91, vol. 2, p. 457), is the only source from which the Mayor and General Council of Atlanta can, in a case like the present one, derive power to charge a street railway company with a portion of the original cost of paving when it lays its tracks upon a street which has already been thus improved.

2. Under this act it is incumbent upon the Mayor and General Council, before granting a street railway company permission to lay its tracks on a paved street, to fix the amount of compensation which will be required of it; and, when no amount has been thus fixed, no demand can be made against the company after the tracks have been laid, either in behalf of the city or of abutting property owners, for the cost of pavement.

3. Where the Mayor and General Council granted such a railway company permission to lay its tracks on a paved street, expressly stipulating that no charge for paving should be made against the company, the General Council could not thereafter, under the provisions of the act above cited, enforce, by execution or otherwise, a claim against the company for any portion of the original cost of laying the paving in that street.—(Atlanta Consol. St. Ry. Co. vs. City of Atlanta, 36 S. E. Rep., 667.)

GEORGIA.—Crossing Other Roads—Additional Servitude—Condemnation Proceedings.

1. Even if the provisions of Civ. Code, sec. 2219, are applicable to the crossing by a street railway of any other railroad, the phrase, "heretofore or hereafter chartered by the Legislature of this State," embraces a street railway company whose charter, though granted by the Secretary of State, has been confirmed and made valid by an act of the General Assembly. A company having such a charter may properly be termed one "chartered by the Legislature."

2. No new burden or servitude is imposed upon a public street or highway by constructing and operating therein a street railway for the transportation of passengers, the cars of which are propelled by electric power.

3. That a street railway company has, under its charter, authority to use steam as well as electricity as a motive power, is a matter of no consequence in testing its right in a given instance to cross a railway on a street under a municipal grant restricting the company to the use of electric power, and where it is not seeking to employ steam power.

4. A railroad corporation which is permitted to construct its tracks across an existing city street or public road does so subject to the condition that it must submit to the increased inconvenience to it which may result from the growth and development of the city or country, and the consequent increase of travel in the usual methods along such street or road.

5. A company owning and operating a street railway of the character above indicated may, under the permission of the proper municipal or county authorities, construct its lines across the track of a steam railroad company, and use the same, without instituting condemnation proceedings, or being required to pay damages.—(Southern Ry. Co. vs. Atlanta Ry. & Power Co., 36 S. E. Rep., 873.)

NEW YORK.—Use—Liens—Two Fares—Right of Lessee—Additional Fare.

1. Railroad Law, sec. 101, declares that no corporation constructing a railroad under that act, or under laws 1884, c. 252, shall charge more than 5 cents for one continuous ride from one point on the road, or from a point on any road, line, or branch, operated by it and under its control, to another, or to a point on any connecting line within the limits of any village, the act not to apply to any road constructed and in operation prior to 1884. Held, that where defendants, owners of an electric line, leased a line run by steam, which had been in operation since 1879, and connected the two, and operated both as electric lines, they had a right to charge a 5-cent fare on each line for a continuous trip over both, since the act restricting the fare to 5 cents has no application to street railways constructed and in operation prior to 1884, or to any road operated by steam.

2. Under laws 1892, c. 676, authorizing any railroad corporation to contract with any other such corporation for the use of their respective roads, where defendants, owners of an electric line, leased a line run by steam, which was constructed and in operation prior to 1884, and connected the two, and operated both as electric lines, defendants, under their lease, acquired the power to charge a 5-cent fare on the leased line, in addition to a fare on its own line, for a continuous trip over both lines, notwithstanding railroad law, sec. 101, limiting charge to 5 cents for continuous ride over company's entire system, since, if the defendant had operated the leased road independent of its own, it could have charged a fare on the leased line.—(Barnett vs. Brooklyn Heights R. Co., 65 N. Y. Suppl., 1068.)

NEW YORK.—Fares—Amount Chargeable—Parties—Private Citizen—Right to Represent Public.

1. Laws 1884, c. 252, sec. 13, as amended by laws 1897, c. 688, sec. 101, provides that no corporation constructing and operating a railroad under such act shall charge any more than 5 cents fare on any line owned or operated by it within the limits of any incorporated city. Held, that a street railway company organized under such act could not charge more than a 5-cent fare within the city limits, whether it operated its own lines, or leased other lines, whose owners had a right to charge a higher rate.

2. A private citizen may not maintain an action to enjoin a street car company from charging an excessive fare, since he suffers no injury not in common with the whole people; the remedy being by Code Civ. Proc. sec. 1798, in an action by the Attorney-General

* Communications relating to this department may be addressed to the Editors, Johnston Building, 30 Broad Street, New York.

to vacate its charter.—(McNulty vs. Brooklyn Heights R. Co., 66 N. Y. Suppl., 57.)

NEW YORK.—Railway on Street—License from City—Abutting Owner—Possession—When Adverse.

1. Defendant and its predecessors in interest for a long time had occupied with tracks the city street on which plaintiff's lot was situated, plaintiff owning the fee to the middle of the street. No compensation was ever made to plaintiff for the use of the street, nor was the right to such use ever acquired from plaintiff. Defendant's entry on the street was under a license from the city, and there was no evidence that any claim was ever made of any rights in the street, except under such license. Held, that such occupation was not adverse to the plaintiff.

2. Possession of the street having been under the license, and not adverse to plaintiff in its inception, in absence of proof there was no presumption, after twenty years, that the character of the possession was changed.—(Monohan vs. N. Y. Cent. & H. R. R. Co.; Thoman vs. same, 66 N. Y. Suppl., 37.)

LIABILITY FOR NEGLIGENCE

KANSAS.—Attorney and Client—Contract with Collection Company—Notice of Attorney's Lien—Settlement with Client. Where B. made an agreement with a collection company to prosecute her claim against defendant, and plaintiffs were the attorneys for such collection company, and there was a contract directly between B. and plaintiffs, subsequent to B.'s arrangement with the collection company, by which plaintiffs should act as her attorneys, and, in spite of notice by plaintiffs to defendant that they claimed an attorney's lien, defendant settled with B., a finding that plaintiffs were not attorneys for B., and not entitled to recover, is not justified.—(Anderson vs. Metropolitan St. Ry. Co., 61 Pac. Rep., 982.)

LOUISIANA.—Injury to Pedestrian.

1. Where the evidence discloses that the electric street car which struck plaintiff was running at a moderate and safe rate of speed, was under the control of the motoneer, that he was sounding his warning gong, that he stopped the car in a brief space of time and distance, and, from the circumstances attending the accident, it is evident she ran into the car without paying any heed whatsoever to its approach, she cannot recover.

2. It is the duty of a person approaching a railway track to pause and look and listen, and govern himself with prudence, according as the situation demands.—(Canedo vs. New Orleans & C. R. Co., 28 So. Rep., 287.)

MARYLAND.—Negligence—Evidence—Instructions to Jury—Depositions.

1. A city, having in use a derrick on the same street as defendant's car line, had a cable attached to the derrick, and extending across defendant's track to the engine by which the derrick was operated. When the cable was tightly stretched, it was at an elevation above the car track sufficient to allow the cars to pass under it, and the city had a flagman to give warning when it was dangerous to pass under the cable, and to signal defendant's motorman when it was safe to go forward; but in passing under the cable the conductor lowered the trolley pole, so as to prevent the pole from coming in contact with the cable. Under these circumstances, one of the defendant's cars being signaled by the city's flagman to proceed, the motorman obeyed the signal, and the base of the trolley pole caught the cable, and dragged the derrick over, causing it to fall upon plaintiff's intestate, and killing him. Held, that it was the duty of the city to keep the cable stretched so defendant's cars could pass under it, and, if the accident occurred by reason of the cable being slack when it ought to have been taut, or because of the city's flagman signaling the motorman to proceed when there was danger, the negligence was that of the city, and not that of the railway company.

2. It not being claimed that the conductor's omission to lower the trolley pole was the cause of the accident, the fact that the conductor was in the forward part of the car, collecting fares, when the accident occurred, instead of being on the rear platform, to lower the trolley pole as the car passed under the cable, was not negligence for which plaintiff would recover of the railway company.

3. An instruction requested by defendant, that the railway company was not responsible for the negligence of the city's flagman, was properly refused because of the assumption that the flagman was the employee of the city instead of leaving the jury to find that fact.

4. Under Code, art. 35, sec. 19, providing that either party may, upon notice to the opposite party, take the deposition of any witness, to be used on the trial "in case only of the death of such witness, or on proof to the satisfaction of the court, of the inability of the party to procure the attendance of such witness at the time of trial," where, after a deposition so taken, the witness appears in court and testifies orally, his deposition cannot be read on a second trial of the cause, although the witness is not then in attendance.—(Baltimore Consol. Ry. Co. vs. State to Use of O'Dea et al., 46 Atl. Rep., 1000.)

NEW HAMPSHIRE.—Carriers—Injuries—Stopping Place—Selection—Liability—Alighting from Car—Duty to Look—Knowledge of Conductor—Negligence—Instructions.

1. Where plaintiff, a passenger on defendant's car, requested the conductor to stop at the first entrance to a cemetery, where she was in the habit of alighting, and where the highway was level with the roadbed, which he failed to do, but stopped a short distance beyond, opposite a hole, into which plaintiff fell in alighting and was injured, the objection that there was no evidence to support a verdict that defendant was guilty of negligence was not well taken.

2. Where the conductor of a street car failed to stop at the place plaintiff requested, but stopped a short distance beyond, where the track ran close to the edge of the highway, and plaintiff, in alighting with a number of bundles and wraps, fell into a hole and was injured, the fact that she did not look at the ground before alighting was not sufficient to charge her with contributory negligence.

3. An instruction that a passenger on a street car has no right to expect that the street where she alights shall be in a safe condition, and that if plaintiff alighted without looking to see where she was stepping, and was injured thereby, she was guilty of such negligence as would prevent her recovery, was properly refused.

4. Where a conductor of a street car ran beyond the regular stopping place, and stopped opposite a hole in the highway, into which plaintiff fell in alighting and was injured, an instruction that the defendant had a right to presume that plaintiff, in alighting from a car in broad daylight, would notice any defect in a street, which was open to ordinary view, at the place where she stepped from the car, was properly refused.

5. Where a conductor of a street car neglected to stop at the regular place, and stopped a short distance beyond, opposite a hole in the highway, into which plaintiff fell in alighting and was injured, an instruction that, if the conductor had no special information as to the condition of the place which the plaintiff did not have the means of seeing or obtaining for herself, he was under no obligation to give her any information in regard to it, was properly refused.

6. An instruction that if the plaintiff, in alighting from a street car in broad daylight, in full possession of her sense of sight, did so without looking to the ground, or using any means of seeing where she was stepping or the distance to the ground, she was guilty of such negligence that she cannot recover for an injury sustained in alighting, was properly refused.

7. Where a conductor of a street car neglected to stop at the regular place, as requested by plaintiff, but stopped some distance beyond, opposite a hole in the highway, into which plaintiff fell and was injured, an instruction that the plaintiff, being incumbered with bunches of flowers and her wraps, was under greater obligations to look where she was about to step than she would have been if she had the free use of her person, was properly refused.

8. An instruction that it was plaintiff's duty to use great care in alighting from a street car, and if there was any defect at the place of alighting which might contribute to her injury, and by looking she could have discovered such defect, but neglected to do so, and the neglect to look contributed to the accident, she could not recover, was properly refused.—(Bass vs. Concord St. Ry., 46 Atl. Rep., 1056.)

NEW YORK.—Negligence—Employees—Incompetency—Fellow Servants—Assumption of Risk—Duty of Conductor—Proof—Objection on Appeal.

1. Plaintiff, a street car driver, in crossing an excavation was obliged to unhitch his team, and leave the car, under the control of the conductor, to come down the grade of its own weight, past the excavation; and, in getting the team around the excavation,

plaintiff stumbled and fell across the track, and the conductor, who had just been hired, and had received no instructions as to the use of the brake, turned it the wrong way, whereby the car ran over plaintiff and injured him. Held, that defendant company was guilty of negligence in not instructing the conductor in the use of the brake.

2. The fact that the contractor making the excavation provided men to push the cars going up grade past the excavation had no tendency to show that it was not the duty of the conductor to take charge of the car while coming down grade.

3. The objection that there was no proof that it was the duty of the conductor to take charge of the car as it passed over the excavation cannot be raised for the first time on appeal.—(Sullivan vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 842.)

NEW YORK.—Contributory Negligence—Injury to Team—Electric Car. Where the driver of the injured team looked down the track as far as he could see (the view being somewhat obstructed), and defendant's car was not in sight till too late to avoid collision, and came very fast, without any signal (the motorman not being at his brake, or where he could control his car), the evidence does not establish contributory negligence of the driver, as matter of law.—(Vitelli vs. Nassau Elec. R. Co., 65 N. Y. Suppl., 1027.)

NEW YORK.—Personal Injury—Conflicting Testimony—Inadequate Damages. Where plaintiff, a boy of seven years, was struck by defendant's street car, and his physicians testified that he was losing his mind because of an injury at the base of his brain, while defendant's physician was confident that no such symptoms were present, judgment for $1,000 in favor of plaintiff will not be set aside as inadequate.—(Simonsen vs. Brooklyn Heights R. Co., 65 N. Y. Suppl., 1077.)

NEW YORK.—Expert Witness—Competency—Striking Out Testimony. In an action against defendant for negligently running into and injuring plaintiff's coach, a witness was allowed to answer the question: "What would you say to be the difference between the value of that coach at the time you saw it there that day and after it left your shop—after it had been repaired?" On cross-examination he testified that he had no remembrance of the condition of the coach before the accident. Held, error to refuse to strike out his testimony as to value, since by his own evidence he was incompetent to tell how much the coach had been injured.—(Eureka Stable Co. vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 509.)

NEW YORK.—Release—Fraud—Effect. A release for injuries sustained by reason of the negligence of defendant, the execution whereof was procured by deceit and fraud, and by inducing the plaintiff, who was illiterate, to believe that he was merely signing a receipt for a gratuity, will not bar an action for such injuries.—(Markowitz vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 784.)

NEW YORK.—Personal Injury—Excessive Damages—Instructions—Exception—Evidence—Withdrawal from Jury—Evidence—Written Statement of Conductor—Admission.

1. Where plaintiff, a boy of eleven years, was injured by a street car, from which he suffered two amputations, and the loss of one limb above the knee, a verdict for $22,500 was not excessive.

2. Where plaintiff was injured by being struck by the fender of a passing street car, which projected over the sidewalk, and the court instructed the jury that it was not negligence for the fender to extend over the curbstone, and cautioned them not to award exemplary damages, and no exceptions were taken to the charge, the objection on appeal that the trial court, in his charge, so unduly minimized the evidence of defendant as to practically withdraw it from the jury, was not well taken.

3. Where a discharged conductor, who had charge of the car when plaintiff was injured, referred on cross-examination to a written statement made by him soon after the accident, and there was no claim that in any way contradicted his direct testimony, it was not error to refuse to admit the statement in evidence.—(Williamson vs. Brooklyn Heights R. Co., 65 N. Y. Suppl., 1054.)

NEW YORK.—Personal Injuries—Negligence—Contributory Negligence—Evidence.

1. Where plaintiff's intestate, a boy between ten and eleven years old, attempted to cross the track 50 ft. in front of defendant's car, and, having stumbled and fallen, was run over by one of defendant's cars, and it appeared that the car was running up grade at the rate of 6 miles per hour, and could have been stopped within 2 ft. to 4 ft., defendant was guilty of negligence, without reference to the question of intestate's contributory negligence.

2. Evidence that plaintiff's intestate had been in the habit of stealing rides on defendant's cars was not admissible in an action against a street railroad company for his death, where it did not tend to prove contributory negligence on the occasion of the injury for which damages were sought.—(Totarella vs. New York & Q. C. Ry. Co., 65 N. Y. Suppl., 1044.)

NEW YORK.—Carriers—Street Car Passengers—Extending Arm—Contributory Negligence—Evidence—Sufficiency—Finding.

1. That a street car passenger, sitting beside an open window reading, with his arm resting on the sill, extended his arm not more than 3 ins. outside the car, did not constitute contributory negligence as a matter of law, precluding recovery for an injury to such arm caused by another car passing on a switch.

2. Where the evidence showed that, at the time of an injury to the arm of a street car passenger by another car passing on a switch, he was sitting beside an open window, reading, with his elbow resting on the sill, without reason to suppose that the cars would be run so close to each other, and the only circumstance showing want of care on his part was that his elbow might have extended not more than 3 ins. beyond the sill, such evidence was sufficient to justify a finding that such passenger was using reasonable care at the time of the accident.—(Tucker vs. Buffalo Ry. Co., 65 N. Y. Suppl., 989.)

TENNESSEE.—Accident at Crossing—Personal Injuries—Action—Trial—Instructions—Evidence—Sufficiency.

1. Plaintiff was injured while crossing defendant's tracks. The evidence was that defendant's track crossed the road on which plaintiff was driving at right angles, the track descending a heavy grade; that defendant's car came down the grade on the night of the injury at the rate of 6 or 8 miles per hour, the motorman ringing the gong for the crossing; that when within 50 ft. of the crossing the motorman loosened the brake and increased the car's speed; that when within 12 ft. he saw plaintiff driving toward the track, and immediately sounded the gong rapidly; that, plaintiff paying no attention to the gong, he reversed the car when within 6 ft. of the crossing, and made every effort to stop it; that the car was lighted inside, and carried a sufficient headlight; and that a person seated on an ordinary wagon, such as plaintiff was driving, could see a car coming on defendant's track for a distance of 750 ft. Held sufficient to sustain a verdict for defendant.

2. In an action for injuries sustained by plaintiff while crossing defendant's track, an instruction: "If no one was in the range of the motorman's vision, or if no one was near enough to * * * the crossing to make the danger of collision probable, he had the right to * * * assume that, if anyone was approaching the crossing, they would have their vehicle under proper control, and would exercise ordinary care to avoid a collision; and no mistake that the motorman made in regard to these two rightful assumptions * * * could be charged to him as negligence,"—was erroneous, since it ignored the question of the speed at which the car was running.

3. Where plaintiff lived 25 miles from town, had crossed the tracks at the point where the accident occurred only four or five times, and was not familiar with their location, it was error to instruct that he could not recover if he failed to look and listen before attempting to cross; for such failure did not constitute negligence *per se*.—(Wilson vs. Memphis St. Ry. Co., 58 S. W. Rep., 334.)

NEW YORK.—Passenger—Injuries—Witness—Cross-Examination—Impeachment—Evidence—Admissions After Accident—Presumption as to Negligence—Burden of Proof.

1. Where, in an action against a street railway company for injuries, defendant calls the conductor of the car on which plaintiff was a passenger, and on cross-examination he denies making an admission to plaintiff after the accident that the car was in bad condition, such matter not having been reverted to in chief, plaintiff's own testimony that he did make such an admission is inadmissible, since a foundation for impeaching the conductor could not be made on a cross-examination concerning matters not testified to in chief.

2. In an action against a street railway company for injuries, evidence of the street-car conductor's admission to plaintiff after

the accident that the car was in bad condition, and that he had so notified his superiors, is inadmissible, since his admissions so made could not bind the company.

3. In an action against a street railway company for injuries to a passenger arising from one car escaping from the control of its driver, sliding down an incline, and colliding with another car at the bottom, it is error to instruct that the burden is on defendant to prove such facts as will demonstrate its freedom from negligence; since, while the presumption arising from such an accident is that the company was negligent, this presumption is merely an aid to plaintiff in sustaining the burden of proof, which remains on him throughout the case.—(Kay vs. Metropolitan St. Ry. Co., 57 N. E. Rep., 751.)

NEW YORK.—Settlement by Client—Attorney's Lien—Rights of Opposite Party. Where an insolvent plaintiff, without the knowledge of his attorney, settled an action for personal injuries after issue joined, and executed a general release of his claim, defendant was entitled to plead such release in a supplemental answer, over the objection of such attorney, though the latter had given notice of an attorney's lien.—(Zaitz vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 396.)

NEW YORK.—Domestic Corporations—Action—Proof—Matters of Record—Appeal and Error. Plaintiff sued defendant, a corporation, in the municipal court of New York City, and recovered judgment, though failing to show the jurisdiction of that court by proving that defendant was a domestic corporation with its principal place of business in New York City. Held, that since these facts are matter of record, and cannot be answered or disputed, she can sustain her judgment by proving them in the Appellate Court.—(Barnett vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 509.)

NEW YORK.—Station—Banana Peeling—Negligence. The fact that a banana peeling was on a stairway leading to a street railway station, on which a passenger stepped, causing him to fall, would not support a verdict against the railway company for injuries, in the absence of a showing of negligence in permitting it to remain there.—(Benson vs. Manhattan Ry. Co., 65 N. Y. Suppl., 271.)

NEW YORK.—Negligence—Elements of Damage—Miscarriage.

1. While plaintiff could not recover for loss of offspring due to a miscarriage caused by the accident in question, yet evidence was admissible to show that her sufferings were increased thereby, notwithstanding her complaint contained no mention of such miscarriage.

2. Same—Verdict—Damages. Where plaintiff was badly bruised on the leg, knee, thigh and hip, and a portion of her extensor muscle was torn from the kneepan, which necessitated the use of a crutch, and was, in the opinion of experts, permanent, a verdict of $3500 was not so large as to warrant its being set aside on the ground that the jury had considered a fact as an element of damage which it was instructed to disregard.—(Witrak vs. Nassau Electric R. Co., 65 N. Y. Suppl., 257.)

A New Text Book on "Electric Law"*

Opinions will always differ as to the value of the modern law text book, whether it is written as an argumentative treatise or in the form of a digest of selected cases arranged in a more or less logical order. But there certainly seems to be a place for a work that seeks to gather between a single pair of covers the law, as expressed in the constitutions, statutes and decisions of the various States, applicable to the various questions which most frequently present themselves to corporations engaged in some specific branch of industry.

It may be an illogical division of the law to attempt thus to combine in one work scraps of constitutional law, discussions of equitable remedies in suits for injunctions and like relief, a presentation of the law of negligence as applied to telegraph companies and the carriers of passengers upon street railways, incorporation, taxation, condemnation and similar subjects, which form the bulk of the litigation and legal questions in which companies using electricity on a large scale are interested. Indeed, one can say, without much fear of contradiction, that the very term "Electric Law," which is the title the Messrs. Joyce have chosen for the latest text-book along these lines, is one which defies logical definition. We do not remember any analogous subdivision of the law—the terms "Steam Law" and "Gas Law" have as yet no place on the shelves of the library or among the subdivisions of the digest.

All this, however, does not militate against the practical usefulness to the officers and heads of departments in telegraph, telephone, lighting and street railway corporations, which use electricity, of a work of a thousand pages, which collates and epitomizes the law to be consulted in answering very many of the questions which arise in the legal complications of the company's business.

In such a work proportion is of the utmost importance. What to omit must be one of the most serious and difficult questions to be determined by the authors. How much space to devote to any subject, which is included in the scheme of the book, is one of equal importance. So difficult are these questions of solution that anyone must despair of producing a work which will solve them all to the complete satisfaction of anyone, including the author himself.

The book now under discussion is not the first upon the subject. In addition to the six volumes of cases collected by Mr. Morrill, under the title of "American Electrical Cases," and covering the period from 1873 to 1897, Mr. Barnard published a monograph on the "Electrical Law" of New York in 1895, and Mr. Croswell, in the same year, published his "Treatise on the Law Relating to Electricity."

Thus the authors of the present volume had the advantage over their predecessors in the opportunity of reviewing recent decisions covering a period of several years, which were not available to their predecessors in the field; while, at least, one of the latter had the advantage of the experience gained in the law department of one of the largest electrical companies in the country.

One peculiarity common to all the text-books referred to, as well as to Mr. Morrill's collection of cases, is the absence of any discussion of the complex, scientific and technical questions of electrical patent law, and it is obvious that that subject could neither be conveniently included within the limits of such a work, nor could it serve any useful purpose therein, except for a very limited portion of its readers.

The Messrs. Joyce have avowedly attempted to write a work which shall be useful, both as one which discusses fundamental principles and one which collects, cites and classifies the numerous decisions which are growing each year in number and variety, and as a result of this double purpose, the work has a two-fold character, which detracts from it as a work of art, but perhaps adds to its value as a practical working tool.

Among the subjects which are treated, more or less exhaustively, are interstate commerce; many phases of negligence law; the application of the Federal Constitution and legislative enactments imposing penalties, the rights of abutting owners, especially in their contests with telephone, telegraph and electric lighting companies. A number of chapters are given to a review of conflicting decisions upon various novel questions in the several States, the chapters being frequently divided into sections, and each section devoted to the legislation and decisions in a different State.

The manifest advantages and usefulness of the volume must appear from this brief review of the scope of the work.

The book, in common with most of our modern text-books, lacks literary style, and, unlike many of them, needs the pruning knife and condensation, rather than expansion, both of the matter and of the manner. The work shows signs of some haste in preparing it for the press, for in some parts of the work repetition is a frequent offense, and especially when the authors undertake to reason for themselves in those parts of the work where they discuss principles, instead of citing and quoting authorities. Section 826 is a flagrant example of this, where the authors criticise the Texas decision of 1881, which holds that damages for mental suffering alone, distinct and separate from physical injury, can be recovered. We read: "Courts should prefer to travel *super antiquas vias*. Precedents must be followed. The rule *stare decisis* is the only safe rule." We cannot see why any one of these sentences does not express the full thought of the authors, nor why any one of the following six or seven sentences in the same section does not fully express the next step in the argument.

The day seems to have passed when we are to receive from the law writers works of literary ability as well as of legal acumen—the days of Blackstone, of Kent, of Story and of Wharton. But perhaps the modern text-book is called upon to fulfil a different mission, and the one under discussion certainly is a practical work of great value on the library shelves of the telegraph, telephone, the electric railway and electric lighting corporations of the United States.

* A treatise on electric law, covering the law governing all electric corporations, uses and appliances, also all relative public and private rights. By Joseph A. Joyce and Howard C. Joyce. Bank's Law Publishing Company, New York, 1900. Pp. 1133; $6.50.

Double-Truck Cars*

How to Construct and Equip Them to Obtain Maximum Efficiency, with Minimum Cost of Maintenance

BY N. H. HEFT

To prepare a paper which would be of any value to the members of this association, it was necessary to learn the conditions governing the operation of double-truck cars on different systems. The conditions under which cars are operated vary to such an extent that it is impossible to construct and equip a car that can be operated with equal economy on each system.

To keep within the time allowed by the committee, and the more readily to convey to the members the writer's opinion as to the most desirable double-truck car, the subject matter will be taken up under the following divisions:

1. Trucks.
2. Electric Motors.
3. Double-Truck Car Body and Equipment.

TRUCKS

The double truck for use on street railways has not received the attention it merits. These trucks have been constructed along the lines of the single truck, and to meet the varied views of railway managements. One has only to observe the different styles of trucks now in use to find how at variance have been their views.

The fifty-five years' experience of the steam railroads in the development of the double truck now used by them should be a warrant to the street railway managements in adopting only trucks that conform to the lines used by these roads. The diameter of wheels, with the tread and depth of flange should be changed only where conditions prevent using the Master Car Builders' standard.

In Figs. 1, 2, 3 are shown a double-truck design, along steam railroad lines, to meet the varied condition of street railway service. In the design of this truck it has been the aim of the designer to include all known good features of the present street railway truck, and to add improvements of value. This truck is constructed with a minimum number of parts consistent with safety, strength, accessibility, lightness and cost of maintenance.

In giving a brief description of the truck shown, it will not be necessary to mention the wheels, further than to say that they are cast chilled, 33 ins. in diameter, with a 3-in. wheel tread, 1-in. flange, formed to fit the modern rail, shown in Fig. 1, weight 380 lbs.

The axles are of forged steel, high in carbon, with a 2-in. hole bored through the entire length. The key seat at gear wheel fit is cut above the line of motor bearings and journals, as shown in Fig. 1, in order not to weaken the axle.

The oil boxes are constructed so that the journal brasses may be readily removed, with dust guard placed in position, from the under side of box. An extra guard is placed from the same side, and where it will retain the oil at the highest point.

The journal brasses and boxes are finished in such a manner as to obtain the full journal bearing under all conditions.

The side frames are made from two ⅜-in. steel plates, thus allowing the main equalizer to be supported between the two frames on long spiral springs. With this arrangement the bar can be removed for repairs without in any way taking the truck apart. This form of frame allows the greatest accessibility to all parts, and the use of the extended equalizer bars, shown on Fig. 1, gives extended spring movement, with a perfect side movement on curves and at low places in the track, minimizing the blow to the car body, rail-joints and special work, and reducing the cost of maintenance of track and equipment. The side frame is so strongly constructed at points where the transom joins the frame that it is not necessary to continue the frame around the end to connect with the other side of frame to keep the truck in alignment. This also allows the placing of the truck near the end of the car body without coming in contact with the steps.

The brake is placed on the inside of wheel, without using a brake beam. This position insures the most positive action, with either hand or power, and independent braking on each wheel. The wheel base, 5 ft. 6 ins., allows the motors to be suspended between axles and transoms.

MOTORS

The writer, having had experience with heavy and light motors, mounted with two motors on one truck, the other truck being an idle or trail truck, as well as with one motor on each truck, has found that, while greater efficiency is shown with the latter method, the two motors mounted on one truck show a saving in labor, first cost of the trail truck, with less cost for maintenance.

Maximum efficiency, with minimum cost of maintenance, with both heavy and light motors, has been obtained by mounting two motors on each truck, making a four-motor equipment. With this form of equipment, higher speed and quicker acceleration are obtained with less power consumption, both in the average and total for the whole trip.

After an experience extending from the time that the first railway motor was constructed, the writer knows of no mechanical apparatus in which the development has been so rapid, and the point of perfection so nearly attained. Yet the future promises even greater development, both in the direct and alternating-current motors. With the great corps of engineers employed by our large manufacturing concerns, working with the men who are operating these motors, and constantly suggesting and demanding improvements, the ideal commercial car equipment will be developed.

The writer desires to call the attention of electrical and mechanical engineers to improving ventilation, increased copper, insulation, bearings, hollow armature shaft, decreased armature speed and gearless motors.

The controllers have not, as far as space and weight are concerned, kept pace with the motors. This part of the apparatus should receive the attention of the best talent of our manufacturing companies. The four-motor controllers, in their present form, are large, cumbersome affairs, placed in that portion of the car body which it is inconvenient and expensive to support. A more satisfactory controller can be produced by using a small pilot controller placed on the platform, with some developed form of main controller underneath the car body.

DOUBLE-TRUCK CARS AND EQUIPMENT

From information furnished by operating department and personal observation, the writer is led to believe the following dimensions the most desirable:

Length over all, 40 ft. to 50 ft.

Width over all, 7 ft. 6 ins. to 8 ft. 8 ins.

With the increasing demand from the traveling public for the extension of present systems to suburban districts, with a more frequent service and increased speed, also the construction of long interurban lines, the present managements, to meet this demand, are turning to the double-truck car constructed along the lines of the steam railroad coach.

In Figs. 1 to 5 will be found a double-truck car, which the writer believes will become justly popular. This car combines the largest number of good features, and is so constructed as to admit of placing the electrical equipment where it is accessible and less liable to come into contact with the truck or brake equipment.

The car body can be carried at the lowest point, and trucks placed near the end of body. This car gives the maximum efficiency, durability, speed, safety and seating capacity, attractiveness and ease and comfort to passengers, coupled with the minimum cost of construction and maintenance, and less dead weight per passenger, based on seating capacity.

The total weight is made up as follows:

Trucks, 3970 lbs. each.

Four motors, 2385 lbs. each.

Car body and equipment, 12,300 lbs.

Making a total weight of 29,780 lbs.

This amount, divided by sixty-three passengers, gives a dead weight of 473 lbs. per passenger. The cars of to-day show a dead weight, based on the seating capacity, of from 750 lbs. to 1100 lbs.

While the writer does not claim that the truck and car body described are perfect, yet he believes they are along lines that will become attractive to managers when taking up the cost of operation. Decreased cost of operation can only be obtained by purchasing equipments that are designed to perform a specific duty where all weights and speeds are known.

The Belfast (Ireland) Tramways Company has just completed very considerable extensions to its tramway system, and will from now on operate an increase of about 2000 car miles a day. About a year ago the corporation of the city made overtures to buy out the company, but satisfactory terms could not be arrived at, and the negotiations fell through. The company will not spend the money necessary to equip the system electrically, having only ten years in which to operate them, and as the corporation cannot arrange terms of purchase, it looks very much as if Belfast would be without electric traction for many years to come.

Dick, Kerr & Company have been awarded the contract by the Corporation of Durban, South Africa, for the complete equipment of its new electric tramway power station plant; all the generators, engines and other equipment of the plant will be of English manufacture.

* Paper read at the Kansas City convention of the American Street Railway Association, Oct. 18, 1900. The views accompanying this paper are not yet ready for publication by the author.

Elevated Railway Cars for Brooklyn

Elevated railway cars have developed in lines entirely different from those found on any steam, cable or electric surface roads. They are unlike steam cars in many particulars, though having a general resemblance to them. Though little like street railway cars in appearance, they have borrowed many of their important features. Lightness is an essential for cars which are to run on elevated structures, because the roadbed is in the nature of a bridge with a limited carrying capacity. For this reason the car framing must be designed with special reference to strength and the workmanship must be that of the street car rather than that usually employed in steam car shops.

The new cars purchased by the Brooklyn Heights road for the Brooklyn Rapid Transit elevated trains are examples of the latest development in elevated railway car operated by electricity. In Fig. 1 an exterior view of one of these cars is shown, and in Fig. 2 the interior. The latter is especially interesting from the fact that the seat arrangement is entirely novel.

These cars were designed and built by the J. G. Brill Company, of Philadelphia. They are 39 ft. 6 ins. long, and but 8 ft. 7 ins. wide. In this dimension the builders were controlled by the limits of the road, which is 8 ft. 9½ ins., the cars being in this case only 2½ ins. inside the clearance. The cars have platforms at each end 3 ft. 4 ins. long. These are arranged in a novel manner, with the view to giving the motorman a complete enclosure when necessary, and at the same time preventing him from the intrusion of passengers. A portion of each platform, at diagonally opposite corners of the car, is vestibuled, and is provided with a double door, giving access to the station platform. This door is cut horizontally in the center, the upper half swinging back against the end of the car and the lower part folding against the dasher. An inner door leads upon the platform of the car, and is hinged so as to swing in both directions. This arrangement gives the motorman a small cab to himself, its width extending from the car door to the side of the platform. The sash in the windows of the cabs are double, the upper portion dropping when desired. The other side of the platform has the usual elevated railroad gate and railing. The platforms themselves are 43½ ins. above the head of the rail. As they are level with those of the stations, steps are unnecessary. This is a characteristic feature of the elevated railway practice, and is caused by the rapidity with which passengers must enter and leave the cars. Passengers are supposed never to enter or leave elevated trains except at stations having proper platforms, hence a stirrup step is the only means for reaching the car from the track level.

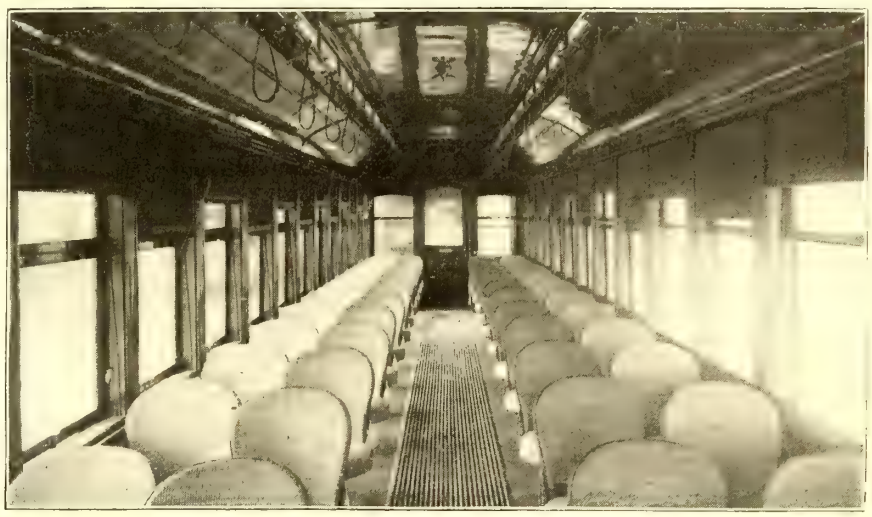


FIG. 2.—INTERIOR OF BROOKLYN ELEVATED CAR

FIG. 1.—NEW MOTOR CAR FOR BROOKLYN ELEVATED RAILWAY

The hood in general appearance is of the regular steam car pattern. Its construction, however, follows street railway practice. It is built over a "form." In this there are material advantages. As the speeds are moderate and great strength is not needed, it is not necessary to carry the main framing of this roof into the hood. In case of minor accidents this effects a great saving, because the whole head may be destroyed without injuring the body of the car or making any repairs upon the framing. With the rails and plates projecting into the hood, as in steam car construction, a comparatively small amount of damage to the hood calls for the splicing of the top plate, and possibly the rails. This is a costly job, usually involving the letter-board panel with the inside finish of the car as well. The steam car construction is much more costly, as plates and rails have to be in these cars at least 8 ft. longer than would otherwise be necessary. The repair of the separate hood is a small matter, and its complete destruction does not necessarily involve any injury to the body.

The body of the car shows an interesting combination of steam and street car practice. As in street car work, there are no panels between the windows, but a sort of compromise is effected. The posts are made in halves and hollowed out to take a tie-rod down through the center. The halves are glued together, thus obtaining space for the steam car tie-rod without using a double post. The strength obtained is greater than that of the single post, but is not quite equal to that of the double posts, with the outside panel and the blocking. At the bottom of the window there is the usual heavy steam car rail gained upon the posts and tying the whole side together very effectively. Below this the straight steam car side is used, but modified so as to let the windows drop, as in street car practice. The usual truss plank edge, bolted and screwed to the posts, is reinforced by a flat truss screwed and gained upon posts and belts. The parts are all put together with white lead. Outside of all comes narrow matched sheathing put on vertically. The truss side thus formed is good, strong and ample for the service, the speed of which usually does not exceed 35 miles an hour at the highest.

The roof itself is of the type that has become standard for both steam and electric cars. It has a monitor or raised deck, carried by the usual iron carlines, which are faced with wood.

The floor frame of these cars is unique, and does not resemble either steam or street car practice. There are four sills; two side sills and two in the center. These are nominally of wood, but are actually of the sandwich pattern, with an I-beam, instead

of a fish-plate, in each. They run straight from crown piece to crown piece of the platforms, passing directly through the end sills. This gives a very strong floor frame by itself, but still further strength is obtained from a pair of short intermediate sills of the same construction as the others, which, starting from the crown piece of each platform, run as far back as the bolsters. The bolsters are of plate iron, very heavy, and frames on the usual steam car lines, a lip at the ends coming down and turning under the side sills. The center sills pass through the bolsters. Under the side sills there are 1¼-in. truss-rods with 1⅜-in. ends. Upon these rods rest a pair of needle beams, supporting the car body in the usual manner. The I-beams, while giving the principal strength, are stiffened by the wood by which they are inclosed. The wood forms an effective means for connecting the posts and truss-plank with the floor. This construction gives a floor frame of enormous strength and rigidity. It is, in fact, quite as stiff and strong as the floor frames of ordinary parlor cars. These cars could be run in fast and heavy steam trains without the slightest danger, being quite up to the demands of that service. The weight of the body alone is 22,740 lbs., a weight below that of a steam car of the same seating capacity.

For the purpose of photographing these cars motor trucks were placed under each end, as will be seen from the engravings. In actual service, however, they are mounted in rather a peculiar fashion. At one end there is one of the Brill No. 27 trucks, carrying two G. E. 55 motors. The opposite end of the car is carried by a master car builders' standard swinging beam truck of the type used for passenger service.

Both motor and trail truck have a 6-ft. wheel base and M. C. B. standard 33-in. wheels. It is expected that the propelling power will be ample for any speed that may be desired upon the elevated road, and it is expected that with an adhesion due to half of the weight, they will be able to surmount any grade likely to be encountered. The No. 27 truck is beginning to be pretty well known among railway men, and it is hardly necessary to speak in detail in regard to it. The frames in this case are solid, and have the swinging links resting on top of the wheel pieces; these links carrying an extra set of springs, making three in all, instead of the two sets employed in the trail truck. These trucks have a rather severe service to perform, since the sharpest curve has only 65-ft. radius. Undoubtedly the motor end of these cars will have a considerably easier motion than the other.

The cars are fitted with a motor-driven air brake. The floors are double with deadening between. The sash are in two parts, the lower, as we have said, drops into the side, as on street cars. When down, a patented locking device covers the opening completely, so that the usual accumulation of dirt in such pockets is avoided. This device, with the arrangement of the sash, was invented by John A. Brill, and is likely to prove of much value from a sanitary point of view. The covering board is locked in place with a thumb nut, securing the parts perfectly, but making access to them easy. The windows are provided with curtains of the usual spring roller type.

The seating arrangements are novel. The seats themselves are cane-upholstered chairs, with stationary backs, see Fig. 2, which shows the interior of the car. These chairs are arranged in pairs, so that the one next the window is diagonally behind the one next the aisle. When it is desired to reverse them they are released by a catch, and are then free to swing horizontally about a central pivot until both have made a half revolution and face in the opposite direction. These seats have not been in use a sufficient length of time to demonstrate their usefulness, but it would seem that they give a very satisfactory solution of the seating problem, since each person is given a seat by himself. At each end of the car at the doors there are the usual stationary seats, placed longitudinally. There are fifty-two of the chairs, giving the car with the longitudinal seats a total seating capacity for sixty persons.

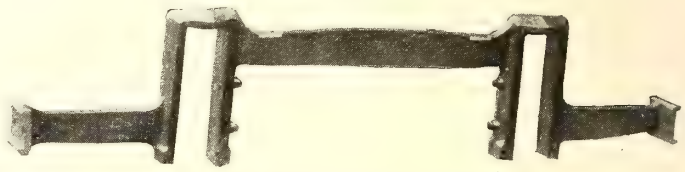
Comparing these cars with a steam railroad coach of a similar capacity, the weight is quite low, being but 38,560 lbs. without the motors. The latter will, of course, add considerably to the total, but as they are the propelling power, which is distributed to the individual cars, and as on the steam road the propelling power is concentrated in the locomotive, it is manifestly but fair to compare the weights without the motor with that of the steam car. In this case the elevated car certainly is lighter by at least 20,000 lbs.

The Liverpool Overhead Railway has recently completed the extension of its system involved in the construction of a tramway at the end of its existing lines to Waterloo and Seaforth. The rolling stock was supplied by Dick, Kerr & Company, and consists of top-seat cars of the standard Preston type similar to those used on the Liverpool Corporation Tramways, and illustrated in a past issue.

Wrought Iron Truck Frame

The accompanying engraving was made from a photograph of a new solid-forged wrought-iron truck side of one piece, made by the J. G. Brill Company for their No. 27 G truck. Heretofore complex truck sides of this pattern have been of steel. For a long time there has been a desire both on the part of the manufacturer and among street railway men to obtain solid forgings in the place of steel. It is generally recognized that forgings for all ordinary sizes are considerably superior in resistance to steel. They can be made lighter and much more shapely. The great expense of forgings, however, has in most cases prevented their use for such complex work as the No. 27 G side. By the most complexed system organized in the hammer department, the Brill company has at last succeeded in producing a truck side of wrought iron at a price closely approaching steel. The engraving represents one of the first of these forgings.

It will be noticed that the truck ends are dropped down very



WROUGHT IRON SIDE FRAME

low upon the jaws; this is for the purpose of enabling the truck to radiate under open cars and to bring the truck side so low as to clear the steps. The forgings are very smooth, and have repeatedly been mistaken for castings on account of their accuracy and the absence of hammer marks. Each jaw is fitted with a gib or wearing piece. This enables the jaws to be renewed to their original size with little difficulty and expense. Just inside of the jaw on the main bar are seen the seats for the links; these come so near to the center line of the jaws that the weight of the body is carried but a very short distance through the frame, practically less than 12 ins. The strains therefore in this important member of the truck frame are reduced to a minimum.

Considered as a piece of blacksmith work this forging is quite remarkable, and will command attention wherever it is seen by experts in the handling of wrought iron. The fact that so complicated a piece of work can be produced at anywhere near the price of steel makes it even more worthy of notice.

Street Railway Encyclopedia

The Mayer & Englund Company, of Philadelphia, is now compiling an elaborate catalogue of practically all the supplies which are used on steam and electric railways at present. The high standing and long experience of the members of this company in the electric railway business insure the accuracy and completeness of a catalogue of this kind. They state that it will be far ahead of anything which has ever been attempted in the line before. The book will contain, as at present laid out, some 544 pages. It will be printed on heavy enameled paper, and will be handsomely bound in silk cloth, making it an ornament as well as a most valuable feature in the library or desk of any railway manager. The extent and labor required in compiling a work of this kind can be appreciated only by those who have undertaken the same character of work. When to this is added the task of making a specialty of typographical appearance, the labor is more than doubled. Nevertheless, the Mayer & Englund Company promises to have the finished catalogue out by Jan. 1, 1901. In spite of the expense of compiling and publishing this book, the company intends to present copies to every manager, superintendent and purchasing agent in the world who is interested in getting the best materials. It is suggested, however, that applications should be made for it early, as the number of copies to be presented must necessarily be somewhat limited, and if there is any delay in making application, there is a possibility of belated requests not being filled.

Illumination from Arc Electric Headlights

The increasing use of arc electric headlights, particularly for high-speed suburban and interurban electric railways, indicates that many roads consider their employment a valuable adjunct in preventing accidents. An excellent idea of the degree of illumina-

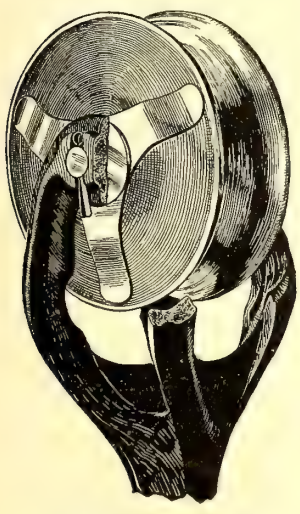
tion produced by one of these headlights is afforded by the accompanying illustration. This engraving is from a photograph taken from the front platform of one of the cars of the New Jersey & Hudson River Railway & Ferry Company, as it was crossing one

VIEW TAKEN WITH ARC HEADLIGHT

of the many trestles on the Hackensack division of that line. The light is thrown a very long distance ahead, and by its means the motorman can easily distinguish any obstacle which may be on the track.

A New Contact Spring for Trolley Harps

The illustration herewith shows a new electrical contact spring for trolley harps, patent upon which has recently been granted to C. S. McMahan, of Chicago. The invention comprises a spring of conducting material pivoted centrally on the pin of the harp, and adapted to press against the inner side of the harp arm. The device has three or more curved radial arms which bear against the trolley wheel near its periphery, at points equally spaced about the wheel. The usual washer is inserted between the spring and the harp arm. The ends of the spring arms



CONTACT SPRING FOR TROLLEY HARP

remain fixed at given points on the periphery of the wheel and revolve with it; the friction due to the rotation of the wheel and spring occurs between the spring and the washer, which is inserted between the spring and the harp arm.

To replace a spring a rod is used which is of the same diameter as the harp pin, the rod gradually tapering to a point. Springs, washers and wheel are first placed approximately in position between the harp arms and the pointed tapering rod passed through to bring all parts to a common center, when the harp pin can be put in place without obstruction.

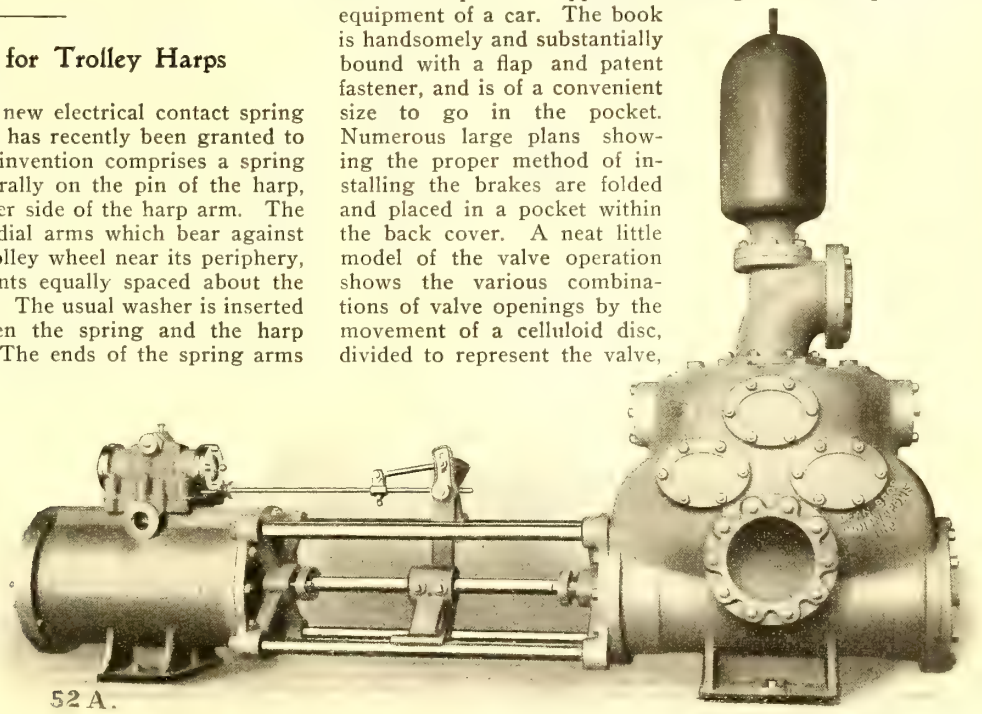
The spring is applicable to any of the existing forms of trolley harps. The chief advantages claimed for the device are: it requires no riveting to the harp; it can be replaced in a moment without the necessity of removing the harp from the trolley pole; it will prevent wobbling of the trolley wheel; it will wear longer than the old form, and, with its three or more points of connection with the trolley wheel, largely increases the contact surface between the wheel and pole, a feature which is especially desirable on large cars using heavy current.

A New Water Supply Pump

This pump is a new pattern, designed especially for water supply or for use in places where the pressure or head against which pump must work is heavy. The steam cylinder is of Dean Brothers usual type, with the noiseless valve gear and adjustable stroke. The stretcher rods connecting the cylinders are of polished steel. The piston rod is of bronze, and the cylinder bronze lined. The pump cylinder is a one-piece casting, with hand-holes of liberal size. The suction openings are on both sides of the cylinder, and the discharge opening may be turned in any direction. The pump may be used for fire protection or any purpose where water under pressure is required, and is manufactured by Dean Brothers' Steam Pump Works, Indianapolis, Ind.

Air Brake Instruction Book

The Christensen Engineering Company, Milwaukee, Wis., realizes that it is of the utmost importance to have the employees of railroads using its air brakes thoroughly understand their operation and care. With this object in view the company has followed the practice, found successful by other large manufacturers, of publishing manuals, showing how to take care of its apparatus. The latest hand book of this kind published by the company is ready for distribution. It contains some seventy pages, describing in great detail the construction and correct management of the various pieces of apparatus which go to make up the air brake equipment of a car. The book is handsomely and substantially bound with a flap and patent fastener, and is of a convenient size to go in the pocket. Numerous large plans showing the proper method of installing the brakes are folded and placed in a pocket within the back cover. A neat little model of the valve operation shows the various combinations of valve openings by the movement of a celluloid disc, divided to represent the valve,



WATER SUPPLY PUMP

over a printed card, showing the inlet and exhaust openings, etc. The illustrations, with which the book is filled, show views of the brakes and parts, as well as many sectional drawings. It would be very advisable for every user of these brakes to have one of these handy volumes; indeed it seems hardly possible for any one to secure the best results unless he has one.

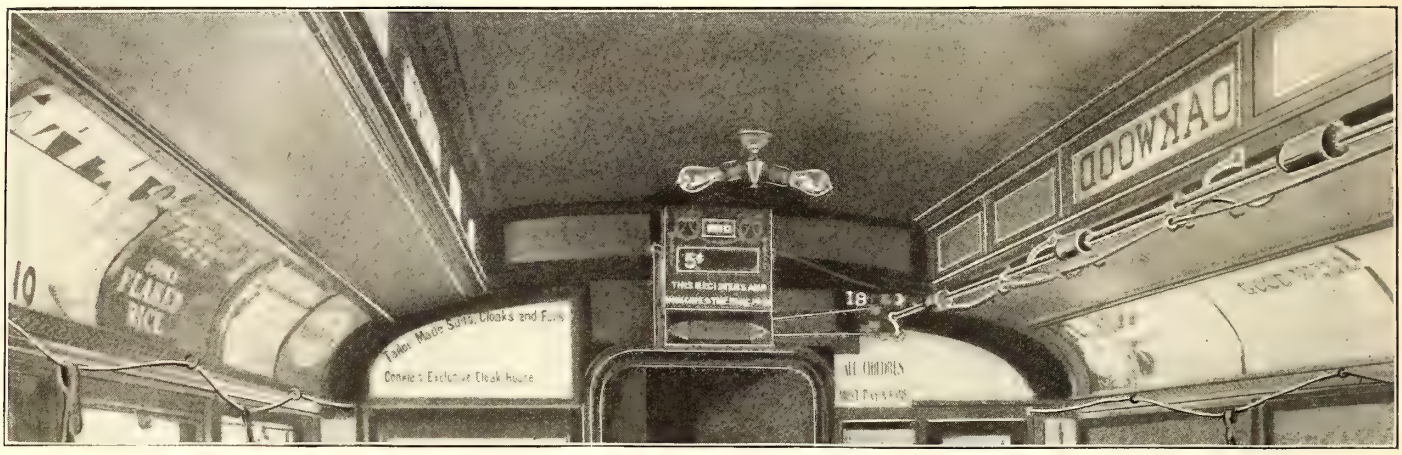
An Improvement in Fare Registers

There is no branch of the management of street railways more important than that which deals with the revenue. This question is a source of constant discussion, and a great amount of time and thought have been devoted to it, but in all the systems so far presented numerous ineffective features are constantly developing. It is an unfortunate thing that humanity is not strong enough to resist the temptations which beset it, but the fact is pretty well recognized that a few loose nickels are liable to become separated from their fellows before reaching the cashier's desk, unless some infallible method of checking is employed. Any system which does not prevent "knocking down" of fares is as objectionable to the honest conductor as to the management, for it not only puts a premium upon dishonesty, but places all the employees under constant suspicion.

The Ohmer Register Company, Dayton, Ohio, is placing on the market a fare register which contains many of the properties of an ideal checking system. At the same time it does its own record making, and is easily operated. The illustrations on this page show the appearance of the instrument and the form of record which it makes. These registers are made for any kind of fare or transfer, and keep a separate record and indication of each. The rod and cord running the length of the car, which are shown in the larger engraving, and which are within easy reach of the conductor's hand, although unlikely to be tampered with, either mischievously or accidentally, by passengers, take the place of the familiar pull straps in ordinary use. The fare is rung up by a pull on the cord, and the kind of fare which has been collected is regulated by revolving the rod in its supporting brackets. The enlarged portions of the rod give sufficient leverage to make the turning of the rod an easy matter. The kind of fare indicated is determined by the position of the rod, the register showing in plain figures the amount previously rung up. Dials in different parts of the car show the conductor the position of the register rod, and enable him to change it accurately and quickly.

There is no totalizer on the register, as it keeps its own record, and does not require that the figures be copied. The indicator at the top shows the number of passengers of all kinds which have been carried on the trip, and is a great help to inspectors or spotters. If the conductor fails to pull the register hard enough, or if he pretends to register and does not complete the operation, a flag rises in front of the indicating figures and shows "Not Registered." One of the cuts shows a sample report which was taken from a register, indicating six varieties of fares. As given, it is about one-third actual size. These records are removed from the register and turned in to the cashier with the conductor's money. They form the only report of fares necessary, and make a conductor's notebook unnecessary. The column on the left shows the number of the trip and the the figures in the other columns the condition of the register at the beginning of that trip. The conductor's report and relief card shows by punch marks the conductor who had a given car, and the time and by whom he was relieved. All that a conductor does, therefore, daily in the way of bookkeeping is to make three or four punches on these cards. It is impossible, therefore, to change the records, even though collusion exists between the cashier and the conductor.

Various other advantages are claimed for this register, a few of which follow in a brief general summary of those already referred to: It registers and keeps a separate account of each fare. It indicates at the time of registration the rate of fares, and this indication is the visible receipt to the passenger for the fare paid, and having given this receipt no doubt or suspicion can form or remain with the passenger as to the integrity of the conductor. It keeps a total record of all fares paid by passengers. It eliminates all bookkeeping by the conductor, and thereby lightens his labors.



GENERAL VIEW OF REGISTER, ROD AND CORD

ROCHESTER & SUBURBAN R. R. CO.
Conductor's Report.

Car No. 7 Register No. A137
Date Oct 6 1900
Conductor G. Smith Badge No. 26
Motorman C. Taylor Badge No. 17
Time out 7 A M. Time in 1 P M.
No. Hours 6
First trip to City ..... or Lake .....

The Ohmer Car Register Co. System. Pat. Oct. 2, 1900

Con.	Trip	Rel'f		Con.	Trip	Rel'f
X	1				16	
	2				17	
	3				18	
	4				19	
	5				20	
X	6	●			21	
	7				22	
	8				23	
	9				24	
	10				25	
	11				26	
	12				27	
	13				28	
	14				29	
	15				30	

NOTE. The trip numbers are indicated by the register. Each conductor will punch the trip number to indicate his time of entering and leaving the car. This card must be returned with the collections from each car.
Note remarks, if any, on opposite side of card.

CONDUCTOR'S SLIP

	5 Cent	Tickets.	Transfer.	15 Cent.	10 Cent.	3 Cent.	
11	2578	1672	1975	1751	2520	3204	A137 OCT 6
11	2578	1672	1975	1751	2520	3204	A137 OCT 6
10	2539	1651	1946	1725	2507	3178	A137 OCT 6
9	2497	1627	1932	1710	2495	3172	A137 OCT 6
8	2462	1589	1903	1687	2486	3164	A137 OCT 6
7	2440	1572	1887	1674	2475	3156	A137 OCT 6
6	2412	1550	1874	1671	2464	3149	A137 OCT 6
5	2404	1543	1868	1666	2461	3147	A137 OCT 6
4	2374	1513	1853	1656	2453	3142	A137 OCT 6
3	2354	1498	1841	1650	2447	3136	A137 OCT 6
2	2334	1478	1831	1640	2442	3131	A137 OCT 6
1	2309	1453	1816	1625	2432	3121	A137 OCT 6
1	2309	1453	1816	1625	2432	3121	A137 OCT 6
	269 5	219	159	126 .15 630 126	88 .10 8.80	83 .3 2.49	

$13.45 - 5¢
18.90 - 15¢
8.80 - 10¢
2.49 - 3¢
$43.69

REPRODUCTION OF PRINTED RECORD

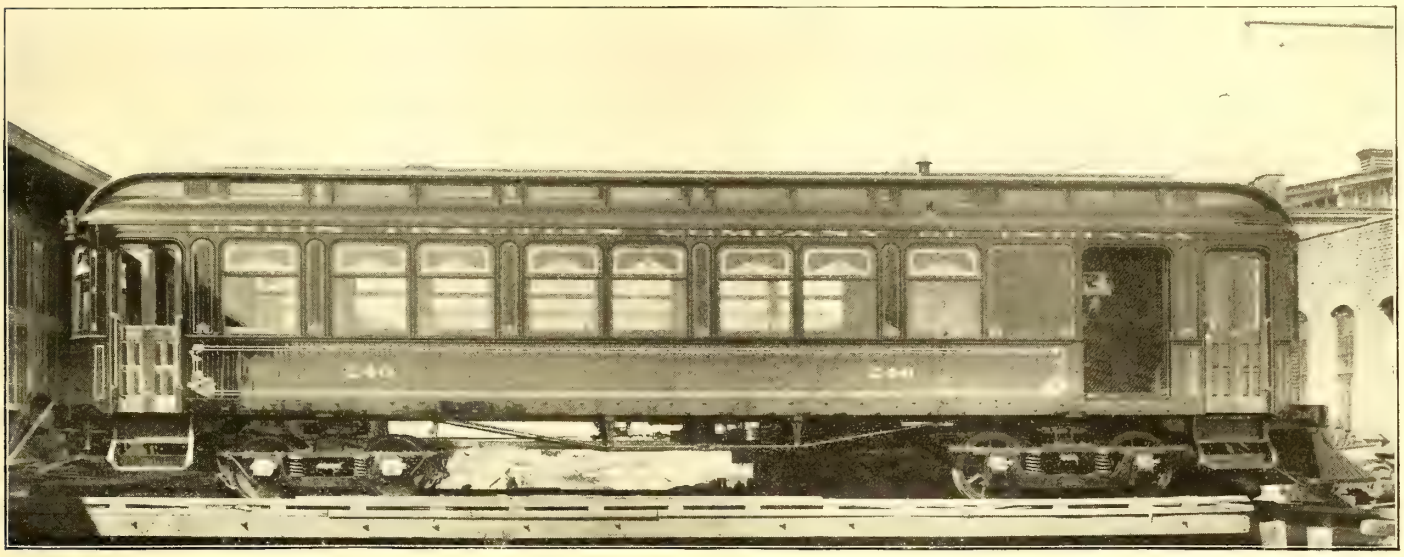
FRONT VIEW OF REGISTER

It takes from the conductor the knowledge of the fares registered in their individual classification, and at the same time provides a way by which receipts may be given from one conductor to another, absolutely checking up the work of each as a whole, and at the same time fixing responsibility of each for the separate classifications of fares collected, the access to which record is given to the office management only. It provides a concise and accurate system for keeping in detail form the fares collected by the conductors, whereby any discrepancies or irregularities in the fares accounted for by the conductors are easily ascertained. It keeps a concise record of the efficiency of the service. The printed report taken from the register each day exhibits by the trip, and for any number of trips combined, all the fares in separate classifications which have been registered.

It relieves the office of a large amount of labor.

Large Cars for Anderson, Indiana

The St. Louis Car Company, St. Louis, Mo., has built twenty closed motor cars for the Union Traction Company, of Indiana, at Anderson, Ind. The length of the car body is 40 ft. Total length over bumpers, 52 ft. 5 ins., height of car from bottom of sill to top of roof, 9 ft. 6 ins. The style is similar in design to a standard railway coach, arranged with a passenger and baggage compartment. The former has eleven seats on each side of the aisle, nine reversible and two stationary end seats, with toilet room, water cooler and heater. The baggage compartment is 8 ft. long, arranged in one end of the car, with a partition and sliding door between the baggage and passenger compartments. The bottom construction is made extra heavy, with built-up steel bolsters, arranged to fit the Baldwin trucks used, and is modern and up to date in every particular. The vestibule has three drop sashes in the end. The car being intended to always run in one direction, the front vestibule is partitioned off between the step entrance and the motorman's compartment, thus permitting the motorman to remain unmolested.



LONG DOUBLE-TRUCK CAR FOR ANDERSON

The interior finish of the car is of cherry, the seats are St. Louis Car Company's walk-over type covered with plush, the headlinings are three-ply bird's-eye maple veneer, neatly ornamented. The car has one No. 8 Baker hot-water heater, equipped with the necessary piping, etc. The floors are covered with cocoa mats and Pantasote curtains are placed at the polished plate glass windows. Each car is equipped with eight brass bundle racks 24 ins. long and about 9 ins. wide, all the trimmings being solid bronze, highly polished.

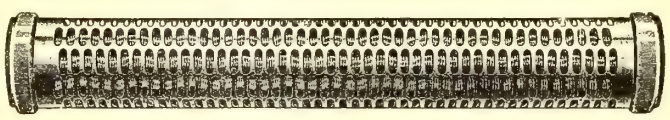
The baggage compartment is arranged with folding seats, so that if at any time it is necessary it can be utilized for passengers. The baggage compartment is also equipped with a small cupboard, furnished with glass doors, containing the necessary tools for wrecking purposes of the same type as is ordinarily put in steam coaches. The baggage compartment is finished on the interior with upright wainscoting, made of ash, and finished in natural color, and is equipped with two side doors, one a solid panel door and the other a wire guard door for use in the summer time. The car is also furnished with wire screens on one side only, which are fastened with brackets so they can be easily removed. The cars are also provided with one signal bell placed in the center of motorman's cab, with bell cord suspended from center dome of ceiling on straps with bronze castings, as usually arranged in steam coaches. A 14-in. alarm gong is placed under the front vestibule. This end of the car is equipped with cow catcher, track scraper and Van Dorn couplers. Christensen air brakes, St. Louis Car Company's patent bevel ratchet brake wheel, and Wagenhals arc headlights are installed on the cars. Their general appearance is shown in the accompanying engraving.

Electric Heaters for Elevated Cars

The cars of the new electric train on the Manhattan Elevated Railway are equipped with the most improved type of Gold's standard electric heaters. The accompanying illustration shows one of these electric heaters, the construction of which is very simple.

The resistance coils are first wound on an open pitch, and supported on the familiar enameled crimped rod which has been used with such great success by the Gold Car Heating Company. These rods hold the heating coils firmly in place, and at the same time permit of a very free circulation of air through and round all parts of the heater. Three intensities of heat may be had.

The regulating switch is so arranged as to throw one-third of every heater in the car in circuit on its first point, two-thirds of every heater in the car on its second point, and the full capacity of all of the heaters on the third, or maximum, point. An even distribution of heat is maintained at all times in this way. The



HEATER FOR ELEVATED CARS

temperature of the car is thus uniform, and an agreeable heat is always supplied. The heater itself is compact, while the resistance wire is absolutely non-corrosive. As a matter of fact, although 60,000 of the Gold electric heaters have been put on the market within the last six years, not one single heater has failed to render entire satisfaction in every way. The heaters make a very handsome appearance in the cars.

Subway Scheme for Chicago

It is announced that a syndicate of Chicago and Eastern capitalists have perfected arrangements for organizing a company with a capital stock of $50,000,000 to construct a subway to relieve the present traffic congestion. Gabriel J. Norden, of Chicago, reprecents the syndicate, but he will not divulge the names of those who are interested in the project. Engineers are now at work on the plans for the proposed road, and, as soon as they have completed their labors, application will be made to the City Council for a franchise. It is announced that the company will accept nothing but a fifty-year franchise grant.

CURRENT NEWS

Chicago's Mayor Petitioned to Adjust Tunnel Differences

Mayor Harrison has been formally petitioned by the executive committee of the Chicago River Improvement Association to confer with the officers of the Union Traction Company in regard to the terms of franchise extension ordinances, with a view to securing the lowering of the tunnels this winter. In a memorial signed by the members of the committee the attention of the Mayor is pointedly called to the fact that the city is in imminent danger of losing the bulk of its river commerce, and he was urgently requested to take steps to avert the threatened calamity. It was pointed out to Mayor Harrison that in the present bankrupt condition of the city the only apparent means of securing the lowering of the tunnels without delay is by reaching an equitable agreement with the Union Traction Company, whereby that corporation will furnish the necessary money and do the work.

To Restrain the Watering of Tramway Lines

An English contemporary states that an effort is to be made under the auspices of the National Cyclists' Union to restrain and test the rights of tramway companies to cleanse their lines by means of the use of water. Several members of the National Cyclists' Union are said to have been injured because of the excessive wetting of the streets by tramway companies, and the cycling organization urges that it is an offense under the "Highway Act" to place anything on the highway which endangers life or interrupts traffic. In many instances, however, franchise grants stipulate that the companies shall keep the highways on which they operate and their tracks in a clean condition, and it is difficult to see how this can be done without the liberal use of water. The companies do not entertain any fears of the contemplated action, but believe that, if suit is brought, it will result in a severe reprimand for those reckless riders who continuously endanger their fellow wheelmen and pedestrians alike. It is hardly possible for one exercising the proper amount of care to meet with serious mishap because of the excessive watering of a street by a tram company.

The Atlanta Controversy Settled

The Atlanta Rapid Transit Company and the Atlanta Railway & Power Company have entered into an agreement by which the long drawn out fight between the two companies and their various interests is brought to a satisfactory close. The actual fight began about two years ago, when H. M. Atkinson asked the City Council for grants in behalf of the Atlanta Rapid Transit Company along certain unoccupied streets and the right to condemn certain stated lengths of tracks belonging to the Atlanta Railway & Power Company. These grants were strenuously and bitterly opposed by the latter company. Fully three months were consumed in arguments before Councilmanic committees having the matter in charge. Finally, by a close vote, Mr. Atkinson and his associates were granted the franchises they had asked for. This was but the preliminary skirmish to the fight that at once began and which has continued without cessation up to the present time. Injunction suits were filed by both parties. The city, State and Federal courts were appealed to, and at length the United States Court of Appeals in New Orleans. While these suits were in progress a board of arbitrators named $12,000 as the price to be paid by the Transit Company for the right to use the tracks of the Atlanta Railway & Power Company on Peachtree and other streets, which had been condemned. The Rapid Transit Company objected to this price and another suit was begun. According to the agreement entered into by both parties, all litigation is to cease. The Atlanta Railway & Power Company agrees to withdraw all its injunction suits now pending against the city of Atlanta. In turn the Atlanta Rapid Transit Company has agreed to pay the Atlanta Railway & Power Company $12,000 for the use of its tracks. In addition the company agrees to cease opposition to the effort of the Atlanta Railway & Power Company and its interests to secure an electric light franchise from the City Council.

Trial Train on the Manhattan Elevated

On November 22 the first official trial trip of an electric train was run on the Manhattan Elevated Railway. A start was made at 10 o'clock from the Sixty-Seventh Street switch yards, and a party of invited guests was taken up the Second Avenue line for about 1½ miles. Several trips were made during the morning, and the train was returned to the yards about 12:30 p. m. Among those on the train were the officers and engineers of the Manhattan Railway Company, Messrs. Vreeland, Starrett and Pearson, of the Metropolitan Street Railway Company; C. L. Rossiter, of the Brooklyn Heights Railroad Company; W. E. Potter, of the General Electric Company; E. E. Gold, W. T. Van Dorn, etc.

The train consisted of six cars, of which the two end cars were motor cars. It was heated throughout with Gold heaters, eighteen to a car, and Van Dorn couplers were used. The motors, of which there were eight to the train, were made by the General Electric Company, and were of 150-hp each. An L 13 controller was used. W. E. Baker, electrical engineer of the company, received many congratulations on the successful operation of the train.

Chicago Traction Suit

Allegations of wrongful use of large amounts of funds of the Chicago Union Traction Company by Charles T. Yerkes and other former officers of the North Chicago Street Railroad Company and the West Chicago Street Railroad Company are contained in an intervening petition filed, Nov. 23, in the original suit brought by Sutro Brothers, of New York, against the Consolidated Traction Company and the Chicago Union Traction Company. The petition is filed in the names of Edwin M. Post and David Christie, shareholders in the Union Traction Company. The validity is questioned of the agreement made in April, 1900, by which the Chicago Consolidated Traction Company secured the right to use the downtown lines controlled by the Union Traction Company in exchange for $6,750,000 of its bonds, which were to be placed with the Equitable Trust Company, to be given in exchange for shares of the capital stock of the Consolidated Company. The bonds were to be guaranteed by the Union Traction Company. The agreement is alleged to be the result of a secret understanding in the petition. "Intervenors charge the actual financial result of said secret understanding and scheme was that Yerkes and his associates in the Consolidated Company fraudulently, illegally and without any real consideration, obtained a gratuitous use of a large amount of valuable property rights of the Union Traction Company—over $400,000 of its cash and several millions of dollars of its personal interest-bearing obligations."

PERSONAL MENTION

MR. JOHN FLINT has resigned as treasurer and superintendent of the Webster & Dudley Street Railway Company, of Webster, Mass. J. Boles Porter has been elected his successor.

MR. A. D. CLAFLIN, president of the Commonwealth Avenue Street Railway Company, of Boston, Mass., has recently been elected president of the Newton & Boston Street Railway, H. B. Parker having resigned.

MR. HARK H. THOMAS has resigned as general manager of the St. Thomas Street Railway Company, of St. Thomas, Ont., to become connected with the J. H. Still Manufacturing Company, of St. Thomas.

MR. H. F. J. PORTER, of the headquarters staff of the Bethlehem Steel Company, has recently presented two papers before the Brooklyn Institute of Arts and Sciences. The lectures were given under the auspices of the department of chemistry, and treated upon the development and modern methods of forging steel. They were profusely illustrated with excellent lantern slides, and included a most interesting description of the Bethlehem steel works.

MR. EUGENE CHAMBERLAIN has been connected with the Brooklyn Rapid Transit Company, Brooklyn, N. Y., for a little over a year, having accepted his present position of superin-

tendent of equipment in October, 1899. Until that time he had had no practical experience in street railway operation. Beginning his engineering work in the humble position of a mechanic in the West Albany shops of the New York Central & Hudson River Railroad, he forced his way to that of assistant superintendent before leaving the shops to become master car builder of the Western division, Syracuse & Niagara Falls, and leased lines. He resigned from this position after having held it for eight years, in order to join the B. R. T., and has already not only completely reorganized the repair shops of that company from a mechanical point of view, but has introduced changes in the accounting and bookkeeping systems which have greatly simplified and improved them. During his connection with the New York Central, Mr. Chamberlain took an active interest in the affairs of the Master Mechanics' and Master Car Builders' Associations, having been on the executive committee of the latter for four years. Mr. Chamberlain's work in Brooklyn is another striking example of the value of steam railroad experience in the operation of street railways.

ENGINEERING SOCIETIES

FRANKLIN INSTITUTE.—A stated meeting of the committee on science and arts of the institute will be held Dec. 5.

ENGINEERS' CLUB OF COLUMBUS.—A regular meeting of this club will be held Dec. 1. Col. James Kilbourne will present a paper entitled "Management of Factory Employees."

THE ASSOCIATION formed by the high-speed engine builders of the country will hold its annual meeting in New York City at Sherry's, Dec. 4. The session promises to be unusually interesting, as papers will be read on "The Relation Between the Engine and Generator" by representatives of the General Electric Company and the Westinghouse Company, from the standpoints of lighting and power. Mr. Armstrong, who has given much attention to steam engine tests, will read a paper on "The Economy of the High-Speed Engine." Builders of high-speed engines will be welcome at this session, whether members of the association or not.

New Publications

Street Pavements and Paving Materials. By George W. Tillson. Published by John Wiley & Sons, New York. 544 pages. Illustrated. Price, $4.

The author has succeeded in treating his subject in a most thorough and comprehensive manner. The book is up to date in every feature, modern methods crowding out antiquated practice in every chapter, although many interesting examples of historical pavements continually keep the student in touch with happy comparisons illustrating the growth of the art of road making. The author has, in fact, taken particular pains to make the opening chapter of the treatise an accurate account of the development of pavements dating back to the days of the ancients. Through the co-operation of consular agents and municipal officials many important data have been collected, and the numerous specifications which have been furnished regarding the construction of standard roadways from all over the world increase greatly the value of this feature. The first few chapters treat of the various materials in more or less of an abstract manner, the separate varieties of any class of material being described and compared before taking up the actual operation of combining them in the completed pavement. A special chapter is devoted to the drawing up of plans and specifications, giving numerous hints as to the best methods of avoiding irregularities and misunderstandings, a large portion of which is as applicable to all engineering undertakings as it is to the particular branch under discussion. More than half of the illustrations in the book are found in a chapter on "The Construction of Street Car Tracks in Paved Streets and Roadways," which points out in detail the relative advantage and disadvantages of the various rails in use and the methods of laying them. On the whole, the volume presents a clear and complete exposition of the subject to the student, and furnishes to engineers an almost encyclopedic book of reference with regard to roads and pavements.

Municipal Improvements. By W. F. Goodhue. Published by John Wiley & Sons, New York. Third Edition. Enlarged. 215 pages. Illustrated. Price, $1.75.

This little book has now reached its third edition. While its aim is not to make thorough engineers of those into whose hands it comes, it has undoubtedly proved of great usefulness in pointing out the numerous difficulties which beset the managers of municipal affairs, and in bringing before them the importance of the problems which it is incumbent upon them to solve. It would hardly be possible for an honest municipal officer without engineering training to read a book which shows in as clear a manner as this one the responsibilities of his position, without becoming impressed with the necessity of weighing carefully his decisions affecting the building or changing of the city works under his control, and selecting with discrimination his technical advisers. Although intended primarily for this class of readers, and written in a manner easily intelligible to them, there is much in the volume which the consulting and municipal engineer will find of advantage. Three new chapters have been added, among them a timely warning against the evils of mismanaged municipal ownerships.

NEWS NOTES

WASHINGTON, D. C.—The Washington Traction & Electric Company recently awarded the St. Louis Car Company a contract for fifty new cars of similar design to those used on the Third Avenue Railroad Company, of New York, and which were described in the STREET RAILWAY JOURNAL. The first instalment of ten cars has begun to arrive, and one of the cars was run over the F Street line Nov. 17. The seating capacity of the cars is forty persons, and the seats are placed crosswise, with an aisle in the center. The new cars are fitted with vestibules, and this is the one feature in which they differ from the New York cars.

BRUNSWICK, GA.—The Council of this place has recently granted a franchise for the construction of an electric railway here.

CHICAGO, ILL.—A car of the Metropolitan Elevated Railroad caught fire a few days ago and was badly damaged. Several men who were on the car made their escape and sought the safety of the street with the aid of ladders. Others journeyed along the foot path to the nearest station.

JOLIET, ILL.—The Joliet Railroad Company has contracted with the Economy Power Company, of this city, to furnish the power for operating its lines in Joliet and Lockport, and for the new line to Chicago.

INDIANAPOLIS, IND.—The City Council has recommended that changes be made in the franchise granted to the interurban lines entering the city, so as to permit the charge of a straight 5-cent fare to city passengers and the issuance of transfers to the local company; also to provide for a tax of 2 cents a round trip for each line.

ELLWOOD, IND.—Henry F. Stillwell, of this city, is at the head of a newly organized company to construct an electric railway from this city to Indianapolis, extending through Tipton.

INDIANAPOLIS, IND.—The County Commissioners have granted Nathan Morris and George C. Webster a franchise for the construction of an electric railway from this city to the west county line. The promoters have already been granted a franchise for a line through Hendricks County.

DETROIT, MICH.—The Detroit Citizens' Street Railway Company has made application to the Council for a renewal of its franchise on Guion Street.

ST. LOUIS, MO.—The City Council of St. Charles has granted the St. Louis, St. Charles & Western Railroad Company a franchise to operate an electric railway in St. Charles. The franchise is to run fifty years, and the road must be completed by July 1, 1902. During the life of the franchise the company must pay to the city, in addition to ordinary taxes, a total of $18,000.

ST. JOSEPH, MO.—J. P. Gibson, of Philadelphia, has become interested in a plan to construct an electric railway between Kansas City and St. Joseph.

ST. LOUIS, MO.—Solomon Boehm and others have made application for a franchise for an electric railway over the Gruvor's road from the western limits of the city to Mt. Sinai Cemetery. The distance is less than a mile. Negotiations are pending with the St. Louis Transit Company for extending its California branch over the proposed route. The right to operate express and funeral cars is asked.

ST. LOUIS, MO.—A car of the St. Louis Transit Company took fire a few days ago and was completely consumed before the fire apparatus arrived on the scene. The passengers all escaped from the car without injury.

WORCESTER, MASS.—President Dewey, of the Worcester Consolidated Street Railway Company, was fined $25, Nov. 19, on complaint that the cars have not been heated to the temperature required by law. The case has been appealed to the Superior Court.

HOLBROOK, MASS.—The Selectmen have granted the Weymouth & Holbrook Street Railway Company a franchise for the construction of its proposed lines through this place.

FOXBORO, MASS.—The Norfolk-Bristol Street Railway Company has made application to the Legislature for articles of incorporation. The company proposes to operate in Foxboro, Mansfield, Sharon, North Attleboro and Attleboro.

AMESBURY, MASS.—The Exeter, Hampton & Amesbury Street Railway Company has made application to the Selectmen of Amesbury for a franchise for the extension of its present lines to the Newton (N. H.) line, where they will connect with the proposed tracks of the Haverhill & Newton Electric Railway, which was recently incorporated at Concord.

WARE, MASS.—The Hampshire & Worcester Street Railway Company has elected directors as follows: H. N. Bates, John A. Perry, of Brookline; James F. Hill, of Warren; S. A. Clark, of North Brookfield; E. E. Beeman, of West Brookfield, and Henry M. Clark, of Ware. At a meeting recently

held it was voted to levy a 10 per cent assessment on the capital stock. The company has accepted all the franchises through the different towns between North Brookfield and Gilbertville, and the road is expected to be in operation by July 1, 1901.

WORCESTER, MASS.—The preliminary organization of the new Worcester & Holden Street Railway Company has been completed. The company proposes to build an electric railway from Chadwick Square in Worcester to Jefferson, with a branch line from Grove Street through Forrest Street to Salisbury, thus connecting with the lines of the Worcester Consolidated Street Railway Company, both at Salisbury and West Boylston Streets. The directors of the company are: Stephen Salisbury, J. E. Fuller, Otis E. Putnam, Jerome Marble, A. B. R. Sprague, John R. Thayer, of Worcester; Henry W. Warren, of Holden.

BOSTON, MASS.—The Railroad Commissioners have dismissed the petition of the Lawrence & Reading Street Railway Company for the approval of a location granted by the Selectmen of Andover, on the ground that the Selectmen did not state whether the tracks were to be laid on the side of the street or the present tracks of the Lowell, Lawrence & Haverhill Street Railway Company, now in the middle of the street, be changed.

WESTFIELD, MASS.—At the annual meeting of the stockholders of the Woronoco Street Railway Company, held Nov. 14, the following directors were elected: James H. Bryan, R. D. Gillett, D. L. Gillett, James A. Crane, Henry W. Ely, Henry M. Van Deusen, Charles J. Little and L. S. Stowe. At a subsequent meeting of the directors the following officers were elected: James H. Bryan, president; Robert B. Crane, vice-president; Charles J. Little, treasurer.

WORCESTER, MASS.—At a recent meeting of the stockholders of the Worcester & Shrewsbury Street Railway Company the following directors were elected: H. H. Bigelow, James M. Drennan, George A. Stevene, F. H. Bigelow and Irving F. Bigelow; H. H. Bigelow was elected president, and Irving F. Bigelow, treasurer and clerk.

LINCOLN, MASS.—As a sequel to the contest which has been going on in this town between the Concord & Boston Street Railway and Lexington & Boston Street Railway, for locations, a remonstrance has been filed with the Railroad Commissioners against the Lexington & Boston's location on Massachusetts Avenue in North Lincoln. At a recent hearing on the matter, Charles Francis Adams, a resident of this town, appearing in remonstrance, made some remarkable statements. He candidly admitted that the Massachusetts Street Railway Law of 1898, passed after a report by a special investigating board, of which he was chairman, was framed under an entire misapprehension of the conditions. He said it never entered his mind that it would be so construed as to prevent a street railway from running over private land without special legislation. It was passed, he continued, under the idea that the electric railway was the successor and counterpart of the omnibus, while in fact the board was dealing with a new force, electricity, which made an electric car in fact a railway running in the highway. He advocated making electric lines vincinage roads, running the cars in trains, permitting them to go over private land as soon as they left thickly settled towns, and permitting them to carry freight. He said no steam road ought to attempt to transport freight within 20 miles of Boston under present conditions, and believed the street railway act should be at once repealed and a new law drawn.

PORTSMOUTH, N. H.—The Portsmouth, Exeter & Newmarket Street Railway Company has just been incorporated with a capital stock of $100,000 to construct an electric railway from Exeter to Portsmouth, passing through Stratham, Greenland, Portsmouth Plains, Newmarket and Newfields. The line will be 20 miles in length. The incorporators of the company are: W. D. Lovell, of Boston; Warren Brown, of Hampton Falls; John Templeton, Rufus N. Elwell, A. S. Wetherell and William Burlingame, of Exeter.

PORTSMOUTH, N. H.—The Portsmouth, Great Bay & Dover Street Railway Company has been incorporated, with a capital stock of $75,000, to construct an electric railway from Portsmouth to Dover, passing through Newington, Durham, Madbury and Greenland. The road will be 15 miles long. The incorporators and directors of the company are: Arthur W. Simpson, of Madbury; Rufus N. Elwell and Albert E. McReel, of Exeter; Wallace D. Lovell, of Boston; Warren Brown, of Hampton Falls, and Joseph Hett and Herbert B. Dow, of Portsmouth.

PORTSMOUTH, N. H.—The Haverhill & Newton Street Railway Company has been incorporated, with a capital stock of $40,000, to build an electric railway from Newton, extending through South Hampton, Plaistow, Merrimac, Mass., and Haverhill, Mass. The incorporators and directors of the company are: Warren Brown, of Hampton Falls; Rufus N. Elwell and Albert E. McReel, of Exeter; Ralph D. Hood, of Haverhill, Mass.; Wallace D. Lovell, of Boston, and John E. Hayford and Irving M. Heath, of Newton.

YONKERS, N. Y.—Two cars of the Yonkers Railroad collided Nov. 18. One of the cars left the track. The passengers were thrown upon the floors of the cars and several of them were cut and bruised.

NIAGARA FALLS, N. Y.—The Niagara Falls & Suspension Bridge Railway Company has defeated the city of Niagara Falls in its fight against an assessment of $39,000 on what was termed improvements on real property. Justice Hooker in the Special Term of the Supreme Court has handed down a decision ordering the amount to be stricken from the rolls.

NEW YORK, N. Y.—The *New York Commercial*, for Nov. 21, says: "Proposals for the establishment of an electric light plant and an electric railway system in the Cuban city of Matanzas are being solicited by Jimenis & Company, of this city, acting for the municipality of Matanzas. The proposals can be made for including both lighting and tramways, or either. The electric light plant is to furnish not less than 225 lights of about 1500 cp, the machinery to have a reserve capacity of at least 15 per cent more lamps. The contractor will be required to furnish a bond in $3,000 American gold, as guarantee for the performance of his obligations. Specifications are in the hands of the local agents, who say that several bidders have already come forward.

MIDDLETOWN, N. Y.—The annual meeting of the Middletown-Goshen Electric Railway Company was held Nov. 15. The old directors were re-elected as follows: W. B. Broomall, Frank D. Graham, W. W. Doughten, J. Howard Roop, Louis H. Duhring, Edward H. Pyle, H. B. Royce and W. B. Royce. At a subsequent meeting of the directors the following officers were elected: William B. Royce, president; W. B. Broomall, vice-president; Herbert B. Royce, secretary and treasurer; Frank D. Graham, assistant secretary.

NEW YORK, N. Y.—Flint, Eddy & Company, Ltd., of New York, have been granted a Virginia charter, giving the company the privilege of conducting a general importing and exporting business, presumably between the United States and the South American republics, preferably Argentina. The capital of the company is placed at $500,000, and the officers are as follows: W. B. Flint, of New York, president; Louis E. Odio, of Buenos-Aires, vice-president; Diego Campbell, of Buenos-Aires, treasurer; William H. Stevens, of New York, secretary. These officers, with Frederick B. Jennings, T. L. Park, Ulysses D. Eddy, Alfred De Buys, George L. Duval and Thomas A. Eddy, of New York, compose the board of directors.

MAYSVILLE, OHIO.—The Cincinnati, Dayton & Maysville Electric Railway Company has been successful in securing a franchise in Loveland. The franchise is for twenty-five years, and the company agrees to have the line in operation by December, 1901. The complete road will extend from Cincinnati through Madisonville, Remington, Loveland, Foster's, King's Mills, South Lebanon, Morrow, Blanchester, St. Martins, Georgetown, Ripley and Maysville. S. Woodward, of Morrow, is largely interested in the new line.

COLUMBUS, OHIO.—The County Commissioners of Pickaway County have granted A. G. Grant, general manager of the Grove City & Green Lawn Street Railway, a twenty-five-year franchise for the construction of an electric railway through the county. As the company now has considerable new construction work in hand, it is believed that the construction of the extension through Pickaway County will be begun at once.

CANTON, OHIO.—T. L. Childs, of Akron, will make another effort to secure a franchise from the County Commissioners for his proposed Akron-Canton line.

GERMANTOWN, OHIO.—The County Commissioners have granted the Miamisburg & Germantown Traction Company a twenty-five-year franchise for the construction of an electric railway between Germantown and Miamisburg. The franchise requires that the construction of the line be begun by May 1, 1901, and that the line be completed within one year from that date.

CIRCLEVILLE, OHIO.—The County Commissioners of Pickaway County have granted the Columbus & Southern Electric Railway Company a franchise for the construction of an electric railway through the county. The franchise is for a period of twenty-five years.

CANFIELD, OHIO.—The construction of the proposed Canfield-Youngstown Electric Railway has been abandoned. Charles Fowler, of Canfield, the local promoter of the line, is authority for the statement. Detroit capitalists were to finance the project.

AKRON, OHIO.—The Cleveland Construction Company was incorporated at Columbus Nov. 19, with a capital stock of $100,000. The incorporators of the company are: Will Christy, J. R. Nutt, W. E. Davis, R. E. Inskeep and D. W. Pell, and the purpose of the company is to promote, finance, own, buy and sell, and contract for the construction of electric railways, railroads, electric light plants, power stations, buildings, telephone systems, gas and water systems; also to act in the capacity of consulting and mechanical engineers. The Cleveland Construction Company is the reorganization of the Cleveland Construction Company, a co-partnership formed in 1889, and composed of Will Christy, president of the Southern Ohio Traction Company; C. W. Foote, general manager of the Arrowhead Reservoir Company, of San Bernardino, Cal., and James Christy, Jr., of Akron, Ohio. The offices of the company will be in the Hamilton Building, this city.

TOLEDO, OHIO.—A number of the prominent citizens of Fremont were recently given a trolley party and a banquet by the officials of the Toledo, Fremont & Norwalk Electric Railway Company. Complimentary speeches were made by the city officials, and deep gratification was expressed at the successful completion of the road. President Comstock, of the company, was presented with a handsome gold-headed cane, and General Manager Stout was presented with a fine silk umbrella.

COLUMBUS, OHIO.—J. M. Wilson, of Dayton, promotor of the Columbus & Southern Electric Railway Company, has applied to the Franklin County Commissioners for franchises over three routes in this county. The first is for a road to extend from Columbus to Washington Court House; the second for a line toward Circleville and Chillicothe, and the third for a road to connect the two, making a loop in Franklin County. Applications have also been made for franchises in the towns mentioned.

NORWALK, OHIO.—The Cleveland, Elyria & Western Electric Railway and the Sandusky & Interurban Electric Railway are having a contest for a franchise over the old State road into Norwalk. The Cleveland, Elyria & Western proposes to extend its road from Oberlin, passing through Florence and Berlin Heights. The Sandusky & Interurban desires to construct a branch line from Ceylon, through Florence and Berlin Heights.

PORTLAND, ORE.—The Portland Traction Company has recently granted its employees a raise in wages. First-year men will receive 17 cents an hour; second-year men, 18½ cents an hour, and third-year men, 20 cents an hour. Formerly the highest paid men in the employ of the company received 18¾ cents an hour, so that the raise is one which will be very acceptable. About a year ago men of more than three years' service were advanced from $2 a day to $2.25, which was the highest wages paid to Portland street-car men up to that time. As all car men work twelve hours a day, the men who have been more than three years with the company will now receive $2.40 a day. The change will affect about ninety men.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week, in order to secure insertion in the current issue.

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Yerkes Awards London Contract

On Nov. 27 H. C. Davis, the representative of Charles T. Yerkes in England, announced that a contract had been completed and would be signed within twenty-four hours giving Price & Reeves the contract for the construction of the Charing Cross, Euston & Hampstead Railroad. The contract involves about $20,000,000. Mr. Davis announced that he would return to the United States as soon as the details were completed.

Reported Negotiations for the Purchase of Washington Properties

A special dispatch from Washington states that Stone & Webster, of Boston, Mass., are negotiating for the purchase of the property of the Washington Traction & Electric Company. Jacob Furth, president of the Puget Sound National Bank, of Seattle, Wash., representing Stone & Webster, was in Washington recently inspecting the lines. Mr. Furth is quoted as stating that while it is by no means settled that the representatives of the various interests will be able to come to terms, he is in Washington to look into the properties and report to those with whom he is interested. The officers of the Washington Traction & Electric Company disclaim all knowledge of the proposed deal.

Councilmanic Fight at Richmond

After a most spirited fight in Council the Richmond Traction Company has been granted the right to operate cars over the lines of the Richmond Passenger & Power Company in Main Street, Richmond, Va. The Richmond Passenger & Power Company bitterly opposed the measure, and the public was highly excited during the time the subject was before the Council.

Consolidation of New Jersey Roads

The Elizabeth, Plainfield & Central Jersey Railway Company has been organized with a capital stock of $3,000,000 to consolidate the existing electric railway lines operating in and about Elizabeth, Rahway and Plainfield, outside the North Jersey Street Railway in Elizabeth. The companies to be consolidated are: Westfield & Elizabeth Street Railway Company, Elizabeth City Horse Railroad Company, Elizabeth Street Railway Company, Plainfield Street Railway Company, and Rahway Street Railroad Company. The lines extend, with branches, to Dunellen, Westfield, Rahway, Boynton Beach, Plainfield, Roselle, Scotch Plains and North Plainfield. The company proposes to issue $2,500,000 bonds, of which, it is said, $1,500,000 will be used to purchase the Kean interest and the Rahway Company. The balance will be used for improvements and extensions. The officers of the company are: David Young, president; Thomas A. Nevins, of Orange, vice-president; Edwin W. Hine, of Orange, secretary; Thomas N. McCarter, of Newark, treasurer.

Brooklyn Power House Destroyed by Fire

The Ridgewood power station of the Brooklyn Rapid Transit, which is situated near the dividing line of Kings and Queens Counties, on Wykoff Avenue, was totally destroyed by fire on the afternoon of Dec. 4. The fire started shortly before 5 p. m., and within ten minutes was beyond control, it being greatly assisted by seven or eight barrels of oil, which had been just rolled into the engine room, and which were reached by the flames before there was time to remove them. The station supplied a large district, which is widely removed from the other power stations of the company, but, by throwing part of the load on the Kent Avenue station and obtaining current from the Coney Island & Brooklyn Railroad Company's lines, cars were again running on schedule time in an hour or two. As soon as the high-tension cables can be obtained and run, rotary converters will be installed, and assist in supplying the district, by taking current from the 6600-volt circuits of the Edison Illuminating Company. The capacity of the demolished station was about 3000 amps., but at the time of the fire it was only about two-thirds loaded. The cause is not accurately known, but was probably a burn-out on one of the generators, causing a short circuit to ground. The estimated loss is some $100,000.

Municipal Ownership at Detroit

Notwithstanding the fact that the Supreme Court has already decided against the municipalization of the electric railway lines at Detroit, Mayor Maybury, in his communication to the City Council on Nov. 20, urges that body to draft a bill for the purchase of the street railways of the city, and asks the Legislature to pass it.

The Mayor reviews the street railway question in the rough; states that the time is drawing near when the city must dispose of this question once and for all, and declares himself in favor of municipal ownership and operation of street railways rather than private ownership, or municipal ownership of tracks with private operation. The Council has referred the matter to a committee.

Storm Causes Damage

The severe wind storm which swept through Ohio, Nov. 26, did immense damage to railway, telephone, telegraph and other electrical property in all parts of the State. At Akron a huge steel smokestack on the power house of the Akron & Cuyahoga Falls Rapid Transit Company fell in, damaging the power house to the extent of several thousands of dollars, and rendering the plant useless for several days. Reports from Cambridge, Warren, Niles, Youngstown, Portsmouth, Lorain and a number of other towns state that the damage to electric wires was very great. The lighting plant at Ravenna was thrown out of service, and the city remained in darkness several days. Service was crippled on a number of electric roads through falling poles.

The Manhattan Railway Tax Suit

The decision of the Court of Appeals in the Manhattan Elevated Railway case, rendered Nov. 27, fixes the value of the property assessable for city purposes in New York City at $9,492,307. This is a reduction of almost one-half from the amount fixed by the local board of assessors, and is in a sense a victory for the company, although to the taxable value of the city will be added the above-mentioned sum, realizing at least annually between $150,000 and $200,000, which the road will have to pay.

In addition to fixing the value of the property for future assessment, the decision compels the payment of back taxes on the same amount since 1895, the last year that the road paid any assessment. This will amount to nearly $750,000. The Manhattan Company attacked the assessment in 1894. It paid the taxes that year and the following, amounting to nearly $1,000,000, under protest, and has not paid since.

The case has been in the court almost continually since that time, and has been appealed several times.

An Ohio Property Changes Hands

The Akron & Cuyahoga Falls Transit Company has been sold to a syndicate composed of Andrew Radel, of Bridgeport, Conn.; Judge Gottfried Krueger, H. M. Doremus and William Sheerer, of Newark, N. J., and E. H. Radel, of Orange, N. J., all of whom are interested in electric railway enterprises in the East. The company operates three lines from Akron, extending to Cuyahoga Falls, Kent and Barberton, respectively, in all about 50 miles of track. The purchasers paid $500,000 for the property, and they have signified their intentions of spending $200,000 in improvements; eventually it will be made the basis of an extensive system. The line between Akron and Barberton will be double tracked, and bids are now being received for ten new cars and other equipment. Ground will be broken at once for an extensive addition to the power house, and two 500-kw generators will be installed, together with new engines and boilers. The line to Cuyahoga Falls will be double tracked to Stow's Corner, 6 miles, and the grades and curves will be reduced as much as possible. The lines were built in 1893, 1894 and 1895 by a company headed by Thomas F. Walsh, of Akron. Mr. Walsh is the present president of the road, and he will not be deposed at once.

Tax Decision Against the Denver Tramway Company

Judge Palmer, of the District Court, in Denver, has just handed down a decision of the utmost importance to the Denver Consolidated Tramway Company, and to all street railway companies in Colorado. The company was plaintiff in the case, and, as the finding was adverse, and involves a large amount of money, it will doubtless carry the case to the Court of Appeals. The suit has been before the court for a year, and has attracted much attention. The action was brought by the company in 1897, to escape taxes which it deemed unjust. The point at issue was whether the tramway company's property should be taxed by the State Board of Equalization or by the county assessor. If it was to be considered a railroad in the statutory acceptation of that word, the company, according to law, was to be taxed by the former; if not, the tax was to be fixed by the county assessor. The company maintained that it should be regarded as a railroad. The valuation of the State Board of Equalization was considerable less than that of the assessor, as it did not include the franchise item, upon which the county assessor placed a value of $550,000. According to the decision the company owes the county, including interest, over $84,000. The decision of the court will vacate the injunction restraining the county authorities from selling the property of the company in payment of the taxes.

The opinion of the court is an exhaustive discussion of the question. It is stated at the outset that the main issue is whether the power to value the property in question is vested in the State Board of Equalization or in the county assessor, and this question is to be decided by determining whether the company is a railroad or merely a street railway. The company maintains that it is a railroad, because it is incorporated for a term of fifty years, according to that part of the railroad statute relating to "Railroad Companies."

Judge Palmer, who rendered the decision, made an exhaustive review of the case and quoted at considerable length from the statutes and from previous decisions. He said in part: "It is contended by counsel for plaintiff that the true test of what kind of a corporation the 'Denver Consolidated Tramway Company was must be determined by the articles of incorporation, and that inasmuch as the plaintiff has fixed its status by incorporating under that part of our statutes relating to corporations which is under the head of 'railroad companies,' no one can question its character as a railroad company. It is pointed out that the intention must have been to make it such a company, otherwise its term of existence would not have been more than twenty years, and, further, that this intention is further shown by the fact that more than five persons associated themselves together to organize the company, whereas, if it was proposed to form a different kind of a company, but three persons might have formed it."

Judge Palmer quotes the statute bearing on the incorporation of railroad companies. They shall specify the places from and to which it is proposed to construct the railway; the time of commencement and the continuance of such proposed incorporation; the names and residences of the persons forming the association of incorporation; in what officers or persons the government of the proposed incorporation and the management of its affairs shall be vested.

The judge cites several cases in point to support his contention that the mere act of the incorporators in organizing under some of the provisions of the statute headed "railroad companies" does not necessarily determine the tramway as a railroad company. As to the technical or legal difference between the words "railroad" and "railway," he holds that the words are synonymous and under all ordinary circumstances they are to be treated as without distinction. For authority in this view he quotes Massachusetts Loan & Trust Company vs. Hamilton, 38 Fed. 592. The position of the plaintiff must be, he says, "that it was the intent of the Legislature to include in the words 'railway companies' all companies operating railways in the State, regardless as to whether it was an ordinary railway company or a street railway company. If such was the intent of the Legislature in enacting the law, then it would be proper for the State Board of Equalization to assess the tramway property and return the same to the county assessor for assessment. If, however, street railways were not intended to be included in the term 'railway companies,' then the State board had no right to assess the plaintiff company."

Judge Palmer takes the position that it was the intention of the Legislature to include in the term such roads as are, according to popular usage, known as railroads. He says:

"The answer of the defendants is that the plaintiff is a street railway, and is operating as a railway. It is unnecessary to point out the difference in the manner of operation and equipment between the two systems, as they are matters of common knowledge. The Supreme Court recognizes the distinction between the two companies in the case of the city for permitting a street railway to be built along a street upon which the plaintiff's lots abutted."

Consolidation of Street Railways in Massachusetts Continues

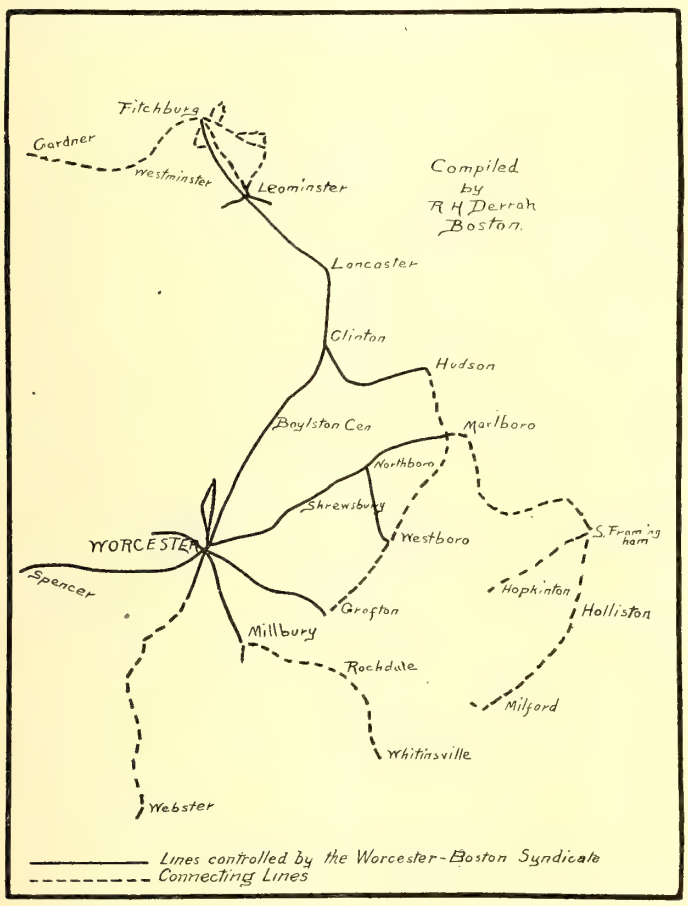
During the past year, practically all the street railway lines in Eastern Massachusetts have been merged into three companies, namely: Boston Elevated Railway, Lynn & Boston Railroad, and Brockton Street Railway, the last two being owned by the Massachusetts Electric Companies.

Following closely on the completion of the Brockton consolida-

tion comes the consolidation of the Worcester companies, a brief mention of which was made in the STREET RAILWAY JOURNAL for Nov. 24. The Old Colony Trust Company, of Boston, which engineered the purchase of the stock of the Fitchburg & Suburban, Leominster & Clinton, Clinton & Hudson, Worcester & Clinton, Worcester & Marlboro and Worcester & Suburban Street Railways, last spring, is conducting the negotiations for the Worcester consolidation, and has taken steps to absorb the Worcester Consolidated Street Railway in the interests of the Worcester-Boston syndicate.

The Worcester Consolidated Street Railway Company has, for the past ten years, been owned by the Worcester Traction Company, a New Jersey corporation, similar to the North Shore Traction Company, which controlled the Lynn & Boston Railroad previous to its sale to the Massachusetts Electric Companies, and the plan of the syndicate, as before mentioned, is to take over and dissolve this company.

The Fitchburg & Leominster, Clinton & Hudson and Worcester & Clinton Street Railways have been consolidated with the Leominster & Clinton, and, at a recent meeting of the Board of



ELECTRIC LINES IN THE VICINITY OF WORCESTER

Railroad Commissioners, the Fitchburg & Suburban, Clinton & Hudson and Worcester & Clinton Street Railways were given the right to consolidate with the Leominster & Clinton. The stockholders of the latter company, as well as the Worcester Consolidated, Worcester & Marlboro and Worcester & Suburban Railways have voted to consolidate, and petitions will be filed with the Board of Railroad Commissioners for the approval of the consolidation. The capital stock of the consolidated companies will not be increased by the consolidation, as the stock of the new company will be exchanged equally for stock of the old companies. No name has as yet been decided upon for the consolidated companies.

The combined statement of the several companies for the year ending Sept. 30, 1900, shows: Track, 140 miles; capital stock, $2,129,400; assets, $4,500,000; funded debt, $1,419,500; floating debt, $796,198; surplus, $174,200; the combined operating expenses of the companies were $765,915, and the combined net earnings were $319,665; the interest of the funded debt, fixed charges, etc., amounted to $208,032, and the net divisible income of the companies was $111,663.

After the consolidation is effected many improvements and new features will be inaugurated. A transfer station will be established in the center of Worcester, where all lines start, thus affording inbound passengers an opportunity to transfer from one line to another within the city limits, and through cars will be run from Worcester to Fitchburg, and Marlboro to Spencer. The main office of the company will be located in Worcester, with branches in Northboro, Leominster and Leicester.

It is learned on good authority that the following gentlemen will be included in the directorate of the new company: Oliver Ames, of Boston, trustee of the F. L. Ames estate, and director of the Union Pacific Railroad; Samuel Carr, formerly president of the Oregon Shore Line Railway; T. Jefferson Coolidge, Jr., chairman of the board of directors of the Old Colony Trust Company; Francis H. Dewey, president of the Mechanics National Bank, and president of the Worcester Consolidated Street Railway; Otis E. Putnam, a director of the Worcester & Marlboro Street Railway; Stephen Salisbury, president of the Worcester National Bank; G. Henry Whitcomb, president of the Worcester & Marlboro Street Railway, and Col. Samuel E. Winslow, president of the Worcester & Suburban Street Railway.

A general manager will be appointed for the company, and he will have entire charge of the system, assisted by three division superintendents. There will be no changes in management of the individual companies until the last detail in connection with the consolidation is completed.

Regular Monthly Meeting of the New England Street Railway Club

The regular monthly meeting of the New England Street Railway Club was held at the Pathfinder Meeting Rooms, 67 Federal Street, Boston, on Wednesday evening, Nov. 28. Although it being the night before Thanksgiving, there was a very large attendance, and thirty-seven applications for membership were voted upon. The constitution and by-laws were formally adopted, and the club is now fully organized with a membership of some one hundred members.

After the adoption of the constitution and by-laws, Mr. Stone made the following remarks:

REMARKS OF MR. STONE

Being heartily in favor of the movement on foot to establish in Boston club headquarters, and observing the marked interest in such a movement, I feel that nothing would increase the membership of the club faster than the establishment of headquarters, or a temporary home, as it might be properly termed. Here, members, when in the city, could visit and find every convenience to which they were accustomed in their own office at home, namely, telephone, telegraph and stenographer's service; also an opportunity to transact business in their own quarters, where they would have an opportunity to look over the records, books and publications for such information as they may require, and even though away from home, be within reach of their home office. This point I think will appeal very strongly to you all, in view of the fact that you often leave home with a hundred and one different things on your mind, and a grave doubt as to whether you can spare time for the trip.

With the plan suggested, of having what is practically a branch office in Boston, where you can be easily reached, it makes it possible for you not only to work to better advantage, but be relieved from a great deal of anxiety. Situated as many of you are at the present time, I have no doubt it is somewhat difficult to make an appointment in advance, and when an opportunity offers itself, whereby you can get away to attend to matters in Boston, the facilities and convenience furnished at headquarters I feel would be very much appreciated. I believe that a member from out of town would find that he could do at least four times as much work in a single day with the advantages afforded him, than otherwise, owing to the fact that he could be receiving and transacting business at headquarters, instead of chasing about town and running the risk of finding people away. If a member has business with a number of concerns in town he can find out immediately at such headquarters whom he can meet to the best advantage to expedite matters, and the chances are that he will discover that he will be able to get back home on a much earlier train than has been his custom. The secretary being established at headquarters, will be able to render us valuable service.

The proposition is one that should not be ignored, and I am satisfied in my own mind that the question which arises in regard to the cost of the maintenance of headquarters is one that can be readily met in a manner which I will describe. In the first place, it has been the expressed wish of many of the members of the club that the proceedings of the meetings be printed and distributed. To do so every month would entail an expense, I should imagine, without looking very carefully into it, of about $500 a

year at the least. This you can readily understand, in view of the subscription fee being $3 per annum, is really beyond what we can afford at the present time, and is, therefore, prohibitive, as much as it is desired.

The plan on foot is that the club have an official organ, which will not only be self-supporting from the income derived from advertising space, but will do more than anything else, in my opinion, to advance the interest of the club. It might be news to many of you present to-night to know that out of the many steam railroad clubs throughout the United States there are ten clubs that publish magazines in the interests of its members. They are:

The New England Railroad Club.
Central Railroad Club, Buffalo, N. Y.
New York Railroad Club, New York City.
Northwestern Railroad Club, Minneapolis, Minn.
Pacific Coast Railroad Club, San Francisco.
Rocky Mountain Railroad Club, Denver, Col.
Southern & Southwestern Railroad Club, Atlanta, Ga.
St. Louis Railroad Club.
Texas Railroad Club, Pine Bluff, Ark.
Western Railroad Club, Milwaukee, Wis.

These publications contain the proceedings of the meetings of the organization, and apparently the supply houses consider them good advertising mediums, or they would not exist as long as they have.

There is absolutely no comparison in the development of steam roads in New England with that of electric lines. Such being the case, the publication by this club of a monthly magazine giving not only the proceedings of the meetings, the same as the steam railroad publications, but information relative to extensions, new lines, and general information of value to those interested in street railways, I am perfectly satisfied, in my own mind, would be interesting, and highly appreciated by members of this club. I think the plan is well worthy of a trial, and I might say that I have consulted a number of members of the club who are prepared to give it their support.

I have made a rough estimate of what I consider the probable income to be derived, and expenses, and I can see no reason why we cannot easily carry the matter through to success, and after the matter has been discussed, provided the same meets with general approval, I will put a motion to have the matter placed in the hands of a committee of five, to be appointed by the president, to make a thorough investigation and report upon the feasibility of the plan.

There is one thing which seems to be favored by a great many street railway men, especially throughout western Massachusetts and Connecticut, which is entitled to consideration. That is, they feel we should have a convention at least once a year. As those in Connecticut and in the western part of the State are nearer New York, I presume they are in a better position to know more about the benefits to be derived from the conventions of the New York City Railway Association, which has been running for the past sixteen years, at least, with great success. I am given to understand that a great many say that if they are assured of a convention each year that they will come into the club without further ado.

Another matter I am told has been brought up. If the western part of Massachusetts or Connecticut has members equal to one-third of the entire membership of the club, or even less, the members are entitled to at least one meeting to every three held in Boston. The same feeling exists throughout Maine and New Hampshire. At the present time we have one vice-president, and I am told that those in other States feel that if this is a New England street railway club, and working in the interests of all, that every State should have such an officer.

So far as a convention is concerned, I know that if the club published a magazine a great deal of interest could be worked up in season to have a convention in the near future that would prove a surprising success, and the more thought that is given to the plan that is before us the more it appears to me to become an actual necessity that the club have an official organ.

The statements which I have just made are based on facts which I have gathered from my own experience and from the experience of our secretary and other members of the club, and express the views of street railway men with whom we have come in contact, and it is my pleasure, gentlemen, to transmit them to you to-night, for I know that, as a club, you are all willing to do anything to advance the interests and standing of this association.

Mr. Kellogg, of Frank Ridlon Company, stated that he was continually traveling throughout New England, and practically all the street railway men expressed their views in favor of the club taking some steps toward carrying out the plans outlined by Mr. Stone. He felt that if such features were carried out they would be the means of increasing the membership very materially, and be a benefit to a majority of its members.

During the business session of the club the following votes were passed:

That the president appoint a committee of five to investigate the feasibility of establishing an office for headquarters of this club in Boston, and report their recommendations at the next meeting.

That a committee be appointed to investigate the feasibility of the establishment and maintenance of an official organ, and that they be authorized to communicate with, and solicit subscriptions from manufacturers and supply, and report their recommendations at the next meeting.

That the secretary be instructed when sending out notices for the next meeting to introduce a clause stating that the subject relating to the holding of a convention next fall will be brought up for consideration.

The constitution of the club has been so arranged that every State in New England will be represented with at least one vice-president.

The president then introduced the speaker of the evening, Mr. Baxter, and stated that he was one of the best equipped men in New England to give the club a talk on the question of accidents, having been closely identified with the West End and Boston Elevated Railways for the past twelve years. Mr. Baxter is chairman of the Board of Aldermen of Medford and nominee for Mayor, and all members trust that he will be elected by a flattering vote. As Mr. Baxter arose to address the members he received a hearty reception.

ACCIDENTS ON STREET RAILWAYS

BY CHARLES S. BAXTER

My connection with the accident business began in the fall of 1886. At that time it was generally believed that street railroading was at its height. Excellent cars were run in the streets, drawn in the summer by two good horses, and in the winter pulled along over snow and ice by a sturdy team of four. Electricity, as applied to street railroading, had hardly been thought of. To look back now we realize, of course, that street railroading was then in its infancy; and as I look back to my experience, I know surely that the accident business was hardly born. At that time the Metropolitan Railroad had a claim agent who acted as assistant to the secretary of the company. The other roads, namely: the South Boston, the Highland, the Middlesex and the Cambridge roads, had so few accidents that their business was attended to by the superintendent himself. C. Q. Ring was the claim agent of the Metropolitan road, and it was his office that I entered, as I say, in the fall of 1886. That year the Metropolitan Railroad Company reported twenty-eight passengers injured and four people killed through the operation of its road. In the fall of the year 1887 the West End road, under the direction of Henry M. Whitney, absorbed all the street railways entering Boston, with the exception of the Lynn and Boston. C. Q. Ring, the old claim agent of the Metropolitan Railroad, assumed charge of the accident department. Horses were still the means used for propelling the cars through the streets, and the accidents did not materially increase. In the year 1888 the West End Street Railway Company reported 158 persons as having been injured, and four persons as having been killed, through the operation of the various combined railways.

In the year 1897 the Boston Elevated Railway leased the West End Street Railway, and soon after began the construction of an elevated road, which is not yet in operation. The accidents have increased in proportion with the number of cars operated and the number of persons carried. To-day the Boston Elevated Railway Company carries nearly 800,000 passengers a day, and this coming year it will report somewhat over 1600 accidents to persons, as having been injured during the year, and some twenty-five persons as having been killed, by reason of the operation of the road.

What has been true of the West End Street Railway has also been true of every other street railway in the United States. The accidents have, some way or other, increased in proportion to the number of persons carried. The first thing that any body of railway men want to know, when discussing the question of accidents, is, how to prevent accidents. Now, the West End management has spent thousands of dollars in using every device that has been known, such as fenders and side gates to cars. They also have the most stringent rules and the most rigid discipline enforced so as to keep the men on the alert to prevent accidents of any kind. It is a singular fact, however, that at this time, after all the expense the railway companies have been put to to prevent accidents, they are now attempting to introduce into the city of Boston a device which any practical railway man acquainted with accidents must know will tend to increase them. I refer to the vestibules on closed cars. It seems to me that placing vestibules on closed cars is a step distinctively behind. Men have stood for many years on the front platforms of cars, and the inconvenience and hardship is no

greater to-day, in fact, it is not so great as it was when it was necessary for a driver of a car to handle four horses in the face of a pelting snow storm in the winter time. Vestibule cars might add to the comfort of motormen, but the danger to pedestrians, the danger to people driving or riding in vehicles and on the cars themselves, would be increased to such an alarming extent that it is to be hoped that an effort will be made now to forever make it impossible to introduce vestibule cars in the streets of Boston.

I presume that most of you gentlemen here represent suburban railways, and, of course, the same conditions would not apply to you as apply to a railway such as the Boston Elevated, operating mostly in the crowded streets of a great city. It is, however, a curious fact, that very few of the accidents of importance that we have to deal with happen in what is called our congested district. Most of the collisions of cars, most of the collisions of cars and teams, and many instances of people being struck by cars in the streets, happen after the cars leave the crowded streets and are running at a more rapid pace in the more open districts. In the congested districts we are more likely to have accidents happen by reason of elderly persons or women attempting to leave the cars before they stop, or attempting to get upon the cars while they are in motion. These people are thrown or twisted solely because of the motion of the car itself. In order to prevent accidents of this nature, our box cars have what is called side gates, and you are perfectly familiar with them.

I am not a great believer in the fender attached upon our cars, and I have never seen a fender that I considered of any great value. There is one matter that it seems to me could be improved upon, and if a proper remedy could be found, would serve to prevent many accidents that now occur as a result of the high rate of speed that cars are run. I refer to the brake. I have made an examination into a number of brakes, and have never yet found one that seemed exactly to fit the bill. It is a curious fact that with all the experiments that have taken place on our cars we are still using the old hand brake. It seems to me that some sort of a hydraulic or an electric brake could be devised, so that cars might be stopped more readily than they are. Brakes, of course, merely prevent the wheels from going round, and it has been argued that wheels would slide just the same if a hydraulic brake were used as they do with the old hand brake; nevertheless, a certain amount of time is used winding the old hand brake, and those few seconds of time in most cases might save serious accidents. I think that this is a matter that managers of railways might give some attention to. I think that this is a thing that managers of suburban railways might especially look into with beneficial results.

Now, I have spoken briefly on the question of preventing accidents. I want to say a word or two about what happens after an accident has actually occurred. Twenty years ago a tort case was an exception in our courts. The bulk of the business was questions of contract and actions of real property. To-day three-fourths of the business of our courts are the trial of tort cases. This means that the communities in which the electric roads have lines have become educated, and are on the lookout for accidents. If one person has an accident, he or she talks it over with some one in the neighborhood, so that when it comes to the neighbor's turn to get hurt, he or she is in excellent condition to enter suit at once. And it is fairly to be said that they are helped on with the doctors. Doctors find accident cases a source of profit, and they work them up accordingly. Then there is the lawyer who starts out with no clients and no business, plenty of time on his hands. He reads of an accident in the paper, and he goes to the home of the injured person, or to the hospital, and solicits the case, and perhaps obtains it. Having the taste of blood, he runs after other cases. As time goes on his business increases, and instead of chasing after accidents himself, he has a corps of runners, or able assistants, who make that their business. Most of these cases are exaggerated, and many of them are absolutely fraudulent. Every large street railway in every city of the Union has to contend with this state of affairs. The amount of money expended by the railways on account of accidents has increased enormously.

I have already used the term "fraudulent cases." I might speak of one or two that have happened in my own experience. You will all recall the accident that happened at Roxbury Crossing in the early part of this summer. In that case the actual number of passengers on our car, by the clock register, was less than forty. There have been claims made against the company by over eighty persons. (Laughter.) This speaks for itself. We have been especially fortunate in the trial of our cases, and perhaps it may be attributed to the fact that we try those cases only where we feel that there is no responsibiliy on the part of the road, or where we have good reason to believe the claimants are frauds. I remember one case which was tried not very long ago, where a plaintiff, who had been injured by reason of a collision of cars, stayed in bed nearly two years and a half. It was absolutely certain that the case was a fraud, and the evidence tended to show that; nevertheless the plaintiff recovered the sum of $5,000, and it was afterward remarked in the court room, that any one who would lay in bed for two years and a half ought to get $5000. (Laughter.) These are simply instances of what any claim agent has to contend with.

We have our entire system working under one system, the road being divided into various divisions, and each accident being looked after by a division claim agent, all responsible to the heads of that one department.

I might go into a long discussion with you as to what is the best method to pursue after accidents happen. I think that this, however, is largely covered by local conditions—the size and kind of the community through which the lines run, and even, perhaps, the size and extent of the railway itself. With these few remarks, which you understand are purely of an informal nature, I will thank you for the attention you have given me. I should be very happy to answer any of the questions that may occur to any of the gentlemen present, or to assist them in any discussion that may follow these remarks.

A rising vote of thanks was tendered Mr. Baxter for his interesting talk on "Accidents." The informal manner in which he discussed the subject made it very much more interesting to the members.

The president then announced that the next meeting of the club will he held at the usual place on Wednesday evening, Dec. 27, when it is hoped that all who are in any way interested in the development of street railways in New England will be present.

The First Annual Report of the Massachusetts Electric Companies

The first annual report of the Massachusetts Electric Companies has just been made public. It is for the year ending Sept. 30, 1900, and in presenting it to the shareholders of the company, President Abbott said, in part: "On June 30, 1899, your trustees took over the various securities and cash composing your property, as set forth in detail in the schedule attached to the trust deed. Among these assets was a controlling interest, and in many cases the entire issue, of the stock of thirty street railway companies, two lighting companies, and a park company, operating respectively in Massachusetts, Rhode Island and New Hampshire. Under the provisions of the trust deed your trustees were bound by contract to purchase the stock of the New Bedford, Middleboro & Brockton Company, and this contract has since been carried out. Under further authority from the shareholders, given at the special meeting on July 30, 1900, your trustees were authorized to purchase by the issue of your shares the capital stock of the Lowell & Suburban and South Shore & Boston Street Railway Companies. Under this authority 12,000 shares of the Lowell & Suburban, and 6574 shares of the South Shore & Boston have been acquired, making the total number of companies in which you were interested thirty-six.

"Of these companies many operated only a few miles of track, and such diversity, both in management and in the system of operation, existed as made efficient supervision very difficult.

"In addition to this the operation of through lines, which the public convenience seemed to demand, was much hampered by the necessity of a series of agreements and contracts between the various companies over whose lines the through cars would pass. It became evident, therefore, that economy of operation and efficiency of service would all be advanced by consolidation of the various companies. Petitions to this end were therefore presented to the Railroad Commissioners, and with their consent many of the smaller companies have been merged into the larger ones, so that to-day the thirty-six companies above referred to have been reduced to fourteen, of which seven are in operation north and seven south of Boston. These companies own and operate 776 miles of track in twenty-three cities and sixty-two towns.

"The total share capital of these various companies amounts to 114,374 shares, of which 104,259 are at present in the possession of the trustees.

"The gain in economy of operation and the improvement in the service which, owing to these changes, the companies have been able to give to the public are most gratifying, and were quickly responded to by a large increase in the number of passengers. This increase, together with careful study and personal inspection of all your properties, made it clear that a considerable expenditure for additional equipment, for reconstruction and extension of tracks, and for increased power, was advisable in the interest of economy, safety, and to supply the additional service which was evidently needed. Carrying out this policy, there has been expended on improvements and extensions during the year $1,055,245.40.

"By far the larger part of this expenditure represents additions to the properties, and was, therefore, charged to capital account, but $154,872.15 were charged to reconstruction suspense account. It is the policy of the companies to continue to make such additions as are needed during the present year, and, above all, to consolidate the power stations wherever by so doing considerable economy in operation can be secured. The various companies have at the present time nineteen power stations and two electric light stations, and it is believed that this number can be considerably reduced, with advantage in operation."

The income account of the Massachusetts Electric Companies for the period ending Sept. 30, 1900, follows:

RECEIPTS			
Dividends			$807,311
Coupons collected			23,850
Interest on notes receivable, on bank balances and miscellaneous receipts			73,597
			$904,758
DISBURSEMENTS			
Expenses		$18,900	
Salaries and legal expenses	$11,261		
Miscellaneous expenses, including expenses of transfer agent	7,639		
Other charges:			
Adjustment of dividends with stockholders, Lowell & Suburban and South Shore & Boston Street Railway Companies	$15,087		
Interest	28,937	44,024	
Dividends:			
Preferred dividend, Dec. 1, 1899	$240,000		
Preferred dividend June 1, 1900	240,000	480,000	542,924
Balance			$361,834

The general balance sheet of the Massachusetts Electric Companies for the year ending Sept. 30, 1900, shows:

ASSETS		
Stocks, bonds, etc		$28,198,225
Cash		321,624
Notes and accounts receivable		636,772
Old Colony Trust Company dividend account		544
		$29,157,165
LIABILITIES		
Preferred shares		$15,056,900
Common shares	$14,292,700	
Less 5750 shares in treasury	575,000	13,717,700
Accounts payable		20,187
Dividends uncalled for		544
Profit and loss		361,834
		$29,157,165

The consolidated income account of the fourteen operating street railway and electric light companies controlled by the Massachusetts Electric Companies shows:

Year ending Sept. 30	1899	1900
Earnings	$5,033,295	$5,518,838
Expenses	3,382,092	3,659,338
Net earnings	$1,651,203	$1,859,500
Charges	941,997	994,294
Net dividend income	$709,206	$865,206
Dividends	439,541	645,545
Balance	$269,665	$219,661
Charges to renewal funds and charges and depreciation and sundry accounts	183,430	182,229
Surplus for the year	$76,235	$37,432

The consolidated balance sheet of the fourteen operating street railway and electric light companies controlled by the Massachusetts Electric Companies, and dated Sept. 30, shows:

ASSETS		
Property	$27,556,721	$28,631,989
Cash	433,165	661,422
Accounts receivable	351,362	*571,673
Materials and supplies	331,424	467,678
Prepaid insurance and taxes	78,924	94,427
	$28,751,596	$30,427,189
LIABILITIES		
Capital stock	$10,656,585	$11,457,400
Funded debt	14,248,000	14,578,500
Notes payable	2,235,949	2,064,507
Audited vouchers	406,476	*811,291
Accounts payable	58,637	62,409
Accrued liabilities	443,448	314,194
Dividends accrued not paid	152,769	375,786
Renewal funds	129,901	109,756
Surplus	419,831	653,346
	$28,751,596	$30,427,189

* These items are abnormally large on account of a debit and credit account running for several years with the Boston Elevated Railway Company for rent of subway. It is expected that an early settlement will be made; the closing of the account will eliminate a large portion of these items.

A list of the companies controlled by the Massachusetts Electric companies, together with the capital shares of each, Sept. 30, 1900:

Beverly & Danvers	120 shares
Brockton	23,124 "
Globe	14,400 "
Gloucester & Rockport	300 "
Hyde Park Electric Light Company	1,000 "
Lowell, Lawrence & Haverhill	15,000 "
Lowell & Suburban	12,000 "
Lynn & Boston	22,710 "
Nashua	2,500 "
Newport Illuminating Company	2,000 "
Newport & Fall River	3,570 "
North Woburn	1,000 "
South Shore & Boston	8,650 "
West Roxbury & Roslindale	8,000 "
Total	44,374 shares

Electrical Goods in Calcutta

R. F. Patterson, United States Consul-General at Calcutta, writes from that city, under date of Oct. 16, 1900, as follows:

"Electricity has not yet been used as a motive power in Calcutta. The Calcutta Tramway Company, Ltd., is, however, now preparing to change its lines from horse power to electricity, and the contract for the power station has been given to Messrs. Dick, Kerr & Company, Ltd., of London. The first shipments for the plant are expected to arrive here in November or December of this year.

"I have answered many letters from our various electrical companies relative to the use of electricity here, calling their attention to the proposed change in the tramway company's lines, and believe that, with proper efforts on their part, the contract might have beeen secured by an American company.

"Electricity is now beginning to be extensively used in Calcutta for various purposes, such as lighting, fans to take the place of punkhas that were pulled by coolies, for driving machinery, etc., and there is an opening here for the sale of electrical machinery and goods, which our manufacturers should take advantage of.

"I would advise correspondence with Messrs. Kilburn & Company, here, who have an electrical plant and are furnishing electricity and electrical machinery and goods; also, with the following named firms in Calcutta, who are dealers in such machinery and goods, viz., Osler & Company, Octavius Steel Company, and the Calcutta General Electric Company.

"All machinery is now entered duty free in India, but there is a duty of 5 per cent ad valorem on goods.

"There is a direct line of steamships between New York and Calcutta, but a cheaper freight on machinery and goods not required for immediate use would be by sailing vessels via the Cape."

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

ELECTRIC RAILWAY PATENTS ISSUED NOV. 20, 1900

661,962. Car Truck; A. B. Du Pont, Detroit, Mich. App. filed Aug. 29, 1899. A continuous side and end frame, supported from and below the journal boxes, and consisting of a pair of edgewise disposed plates, arranged side by side and separated from each other at the sides of the truck, and brought together and rigidly

secured to each other at the end portions, distance pieces secured between the side portions of said plates and supporting the car springs and journal-box straps, and upwardly extending bolster guides also secured between and spacing the side portions of said plates.

662,006. Mechanism for Raising or Lowering Footboards on Open Cars; R. E. Lintner, Pittsburgh, Pa. App. filed Sept. 7, 1900. By a suitable system of levers the car attendants are able to raise and lower the side steps.

662,009. Trolley; F. A. Merrick, Johnstown, Pa. App. filed Jan. 18, 1900. A contact device is secured to the wheel or its hub, and maintained in constant contact with the wheel shaft by a spring which connects it to the wheel or hub.

662,012. Friction Brake; J. H. K. McCollum, Toronto, Canada. App. filed March 25, 1900. Through a system of levers, wedge-shaped rollers are inserted between two sliding collars to force the friction surfaces into contact with each other.

662,016. Railway Switch; H. O'Shea, Johnstown, Pa. App. filed Dec. 28, 1899. The pivot pin of the switch tongue is tapered and seated in a tapered socket, so that any wear which takes place will be compensated for by a deeper seating of the pin in the socket.

662,071. Track Structure; H. O'Shea, Johnstown, Pa. App. filed Dec. 28, 1899. The tread portion of the rail is set loosely into a groove in the upper face of the girder.

662,218. Electric Car Sign; I. B. Brower, Philadelphia, Pa. App. filed Nov. 15, 1899. The circuit of the lamps in the sign extends through the metallic bracket which supports the sign on the car.

662,360. Means for Applying Automatic Air Brakes in Emergencies; J. F. Hutchisson, Mobile, Ala. App. filed June 21, 1900. The train pipe is exhausted when a lever, carried near the rails, is struck and moved by an obstruction or by the derailing of the train, the lever then acting on valves in the train pipe.

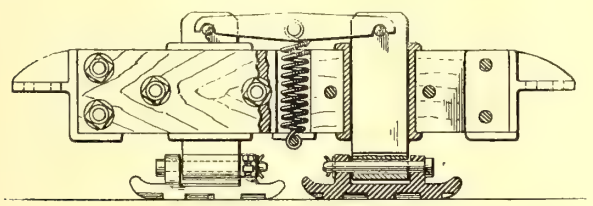
ELECTRIC RAILWAY PATENTS ISSUED NOV. 27, 1900

662,419. Electric Railway; W. Grunow, Jr., Bridgeport, Conn. App. filed April 5, 1900. Relates to the alternate placing of supply and energizing conductors in each successive section of twin third rails, so that both conductors of a section have a like or equal potential and polarity when charged.

662,420. Electric Railway; W. Grunow, Jr., Bridgeport, Conn. App. filed April 5, 1900. A manually operated switch is provided by which the motorman can re-establish the circuit to the sections should it become broken, the switch being located in the roadbed.

662,421. Electric Railway; W. Grunow, Jr., Bridgeport, Conn. App. filed April 5, 1900. A modification of the preceding.

662,423. Current Collector; W. Grunow, Jr., Bridgeport, Conn. App. filed April 5, 1900. The collector consists of two shoes, yieldingly secured to a supporting frame by vertically sliding standards and pivot pins, the standards being connected by a yoke.



PATENT NO. 662,423

662,456. Safety Device for Street Railway Cars; T. Mulholland, Pittsburgh, Pa. App. filed Aug. 28, 1899. A fender intended to maintain a person who is struck by it in a vertical position.

662,540. Axle for Railway or Road Vehicles; A. C. Massey, Los Angeles, Cal. App. filed May 29, 1899. A divided axle having the abutting ends acting against rollers or balls.

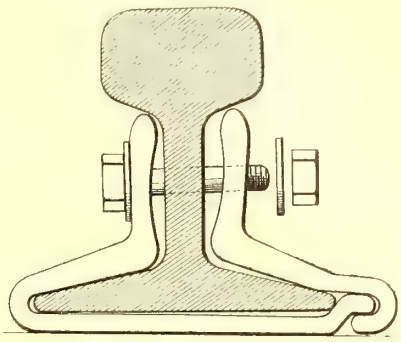
662,595. Trolley Wire Suspension; J. W. Haynes, Manchester, Conn. App. filed March 10, 1900. A latch secured to the bracket fits into a notch in the cap of the insulator, and prevents it from unscrewing.

662,712. Splice Joint for Railway Rails; W. B. Doodridge, St. Louis, Mo. App. filed Aug. 2, 1898. An arrangement whereby a split key can be tightened up as often as required without displacing the joint.

662,773. Railroad Tie; E. Davis, Brazil, Ind. App. filed Dec. 27, 1899. The cross-tie is secured to hollow base blocks beneath each rail.

662,809. Rail-joint; J. S. Patten, Baltimore, Md. App. filed April 21, 1900. A chair adapted to clasp the joint and interlock with a fish-plate when the bolts are set up.

662,841. Metallic Railroad Tie; J. S. Warley, Pottstown, Pa. App. filed May 28, 1900. The tie-plate is secured at each end to sheet metal sills, to which it is pivoted, the sills are provided with lugs, which are brought into and out of engagement with the flange of the rail by slightly turning the sills.



PATENT NO. 662,809

662,850. Tie-Plate; H. W. Avery, Cleveland, Ohio. App. filed Jan. 5, 1900. The plate is provided with lugs to engage the rail flange and spike holes for fastening it to the tie, the holes being specially located with reference to the lugs.

PERSONAL MENTION

MR. HENRY EVERETT, of Cleveland, president of the Cleveland Electric Railway Company, and a heavy stockholder in a number of roads in various parts of the country, sailed for Europe last week.

MR. DUNCAN McDONALD has resigned as superintendent of the Montreal Electric Street Railway Company to accept the position of general traffic manager of the General Traction Company, of Paris, France. Mr. McDonald will sail for Paris in a few days, and will assume his new duties on Jan. 1.

MR. W. H. LAWRENCE, president of the National Carbon Company, died at his home in Dover, Ohio, Nov. 23. In July last Mr. Lawrence met with an accident, receiving injuries that necessitated the amputation of his arm. He failed to rally from the shock, and complications set in which finally caused his death. He was sixty years of age.

MR. W. D. RAY has been appointed to succeed Mr. Bret Harter as electrical engineer of the Detroit, Rochester, Romeo & Lake Orion Railway, North Detroit Electric Railway, Grand Rapids & Holland Railway, and Detroit, Lake Orion & Flint Railway. Mr. Ray was formerly manager of the Everett Railway & Electric Company, of Everett, Wash.; also general manager of the G. P. Magann Air Brake Company.

MR. SAMUEL McCLINTOCK HAMILL, of Schenectady, N. Y., and Miss Maria Woodward Baldwin, of Baltimore, Md., were married at Grace P. E. Church, Baltimore, on Nov. 27. The maid of honor was Miss Sara Baldwin, a sister of the bride, and the best man was Mr. W. Butler Duncan, of New York. The ushers were: Messrs. Robert Emmett, William Woodward and Carroll Baldwin, of New York; Mr. Horace Devereux, of Colorado Springs; Mr. Barker Cummere, of Trenton, N. J.; Messrs. Gist Blair and Blair Lee, of Washington, and Mr. Summerfield Baldwin, of Baltimore. A reception was held at the residence of the bride's parents after the ceremony. Mr. Hamill now holds a prominent position with the General Electric Company at Schenectady, and is also well known as president of the Siemens-Halske Company. He was also connected with the Brush Company, of Cleveland, for a long time.

MR. HERBERT E. BRADFORD, superintendent of the Marlboro Street Railway Company, of Marlboro, Mass., is slated for an important appointment in connection with the consolidation of the electric lines in and about Worcester. Mr. Bradford entered the employ of the Marlboro Street Railway Company in 1888, which was his first railway venture, and has remained with the company continuously since that time. His first position with the Marlboro Street Railway Company was in a minor capacity. His tact, however, secured for him the position of superintendent on the death of S. C. Darling. Mr. Bradford was born in Keene, N. H., in 1858. He was apprenticed as a machinist, and served eleven years at the trade. He came to Marlboro in 1883, and entered the employ of Gen. Henry Parsons. This position he resigned after a few months, and accepted the position of master mechanic and chief engineer for the Boyd-Cory Shoe Company, the largest shoe

manufacturers in the city. This position he resigned to enter the employ of the Marlboro Street Railway Company.

MR. JAMES AFFLECK, secretary and treasurer of the Eighth Avenue Railroad, and vice-president of the Ninth Avenue Railroad, of New York, died Nov. 24. Mr. Affleck was in the seventy-fourth year of his age, having been born June 11, 1827, in Kirkpatrick-Durham, Scotland. He came to the United States in 1849, and soon after entered the employ of the Hudson River Railroad Company. About a month after connecting himself with that corporation, he was made cashier. He remained with the company until 1873, when he left to accept a responsible position with George Law. He became connected with the Eighth Avenue and Ninth Avenue Railroads in 1874, and in 1896 he was elected vice-president of the Ninth Avenue Railroad. For many years he held the position of secretary of the Brooklyn & New York Ferry Company, a corporation controlling most of the ferries plying in the East River. George Law died in 1880, and Mr. Affleck was made executor and trustee of the estate, estimated at $15,000,000. He continued in that capacity up to the time of his death. Mr. Affleck is survived by a wife.

MR. CHARLES S. BAXTER, of Hyde & Baxter, attorneys for the Boston Elevated Railway Company, was born in Boston, Aug. 27, 1867, and received his preliminary education at the English High School and at C. W. Stone School, Boston. He entered Harvard College, and graduated from the latter institution in 1892. After leaving the English High School, Mr. Baxter entered the claim department of the Metropolitan Railroad, and maintained his connection with the claim and law departments of the West End Street Railway. In 1896, with Mr. Louis F. Hyde, he formed a law partnership, known as Hyde & Baxter, and entered the general practice of law. In January, 1898, Messrs. Hyde & Baxter became the attorneys for the Boston Elevated Railway, a position they still hold. Mr. Baxter has been a resident of Medford, Mass., for the past fifteen years, and has been prominently connected with all the social organizations of that city. Besides his local connections, he is a member of the University and Exchange Clubs, of Boston, and the Harvard Club, of New York. He served in the Medford Council for two years, and has been a member of the Board of Aldermen for two years, being president of the board this year. At the present time he is the Republican nominee for Mayor of that city.

CHARLES S. BAXTER

ENGINEERING SOCIETY

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.—Professor John S. McKay, Ph. D., of the Packer Collegiate Institute, will deliver his fifth lecture in the course on "The Theory of Electricity" before the Institute on Dec. 10. The subject of the lecture will be "Electric Attractions and Repulsions," and it will be illustrated by experimental demonstrations.

NEWS NOTES

SAN FRANCISCO, CAL.—The Howard Street electric line of the Market Street Railway was recently placed in operation in connection with the completed portion of the Fifth Street electric line. The new division extends from Fifth and Market Streets to Twenty-Sixth and Missouri Streets.

MIDDLETOWN, CONN.—The Middletown Street Railway Company will apply to the incoming Legislature for an amendment to its charter, permitting it to extend its lines from Middletown to Meriden. Such an amendment was asked for at the last General Assembly, but it was refused. A most determined effort will be made to obtain the amendment to the charter.

KEY WEST, FLA.—The employees of the Key West Electric Company are on strike and no cars are being operated. So far, all negotiations for a settlement of the difficulty have been unavailing, and it is stated that the company has threatened to withdraw from the city altogether.

CLARKSVILLE, GA.—The Nachooche Railroad Company has just perfected its organization. Among those interested in the company are C. E. Cook, of Chicago; John Martin, C. W. Oaks, R. A. Williams, Charles Roberts, of Nachooche; C. W. Humücut, of Atlanta; Walter L. Childs, of Athens; J. H. Hicks, William Berry, Charles L. Boss, W. S. Erwin, of Clarksville.

FORT WAYNE, IND.—Townsend, Reed & Company, the promoters who are backing the proposed electric line from this city to Huntington, have purchased the bed of the old Wabash & Erie Canal for a distance of 15 miles. The roadway is 60 ft. wide. The projectors have also secured the right of way into Fort Wayne.

INDIANAPOLIS, IND.—The Marion County Commissioners have granted the Indianapolis & Lebanon Traction Company a franchise for the construction of an electric railway on the Lafayette pike from Indianapolis to Lebanon. The franchise provides that cars must be running by May 1, 1902, and extends for fifty years, the company to pay the county annually $25 a mile for each mile of the pike used. The promoters say they will ultimately build to Lafayette. Among those interested in the company are: A. A. McKain, J. M. Mankee, E. T. Dawson, J. S. Holliday and A. M. Gloss Brenner.

CHICAGO, ILL.—The Citizens' Electric Street Railroad Company has made application to the City Council for a franchise for the construction of an electric railway from Foster and Evanston Avenues to the city limits, a distance of about 6 miles. The company desires a twenty-year franchise. The Citizens' Electric Street Railroad Company is understood to be the company in which Charles L. Bonney, Lyman M. Paine and other Chicago capitalists are interested.

FORT WAYNE, IND.—L. B. McIlheny, of Dayton, Ohio, has been granted a franchise giving him an entrance into the city for the proposed electric railway, from Decatur to Fort Wayne. The road is to enter the city at Piqua Avenue, thence to Johns Avenue, to Calhoun Street, and north on Calhoun Street to Creighton Avenue, there to connect with the Fort Wayne Traction Company's lines. The life of the franchise is limited to fifty years, and the city reserves the right to grant to any other interurban companies a franchise over the same route, the tracks to be used jointly, subject to certain stipulations as to payment, cost of maintenance of tracks and right of way, etc. The line is to be built from Decatur to the city limits before the city franchise becomes operative. The fare for adults is fixed at 5 cents, and it is stipulated that conductors shall at all times carry a supply of tickets to be sold on the cars at the rate of six for 25 cents or twenty-five for $1.

INDIANAPOLIS, IND.—The Indianapolis, Morristown & Rushville Railway Company has made application to the County Commissioners for right of way in this county for the electric interurban line, to connect the three places mentioned in its title. The line is to extend from Prospect Street and Keystone Avenue, the end of the Prospect Street line of the Indianapolis Street Railway Company's system. The promoters announce that work will begin on the line in the spring if the grant is made.

NORFOLK, MASS.—A car on the Norfolk Suburban Street Railway ran off the track on East River Street, Hyde Park, Nov. 25, and several persons were injured. The passengers were thrown into the forward end of the car, and it was with difficulty that some could extricate themselves from the mass of humanity. Fortunately, however, no one was killed, nor were any bones broken.

BOSTON, MASS.—Several new petitions have been filed for legislative action. The Webster & Dudley Street Railway Company asks authority to lease connecting or intersecting lines, or to lease to any one of them. The Westboro & Worcester Street Railway Company and the Marlboro & Westboro Street Railway Company each ask authority to sell or lease its property to the other to effect consolidation. Henry H. Crapo and others ask incorporation as the New Bedford & Onset Bay Street Railway Company, with authority to act as a common carrier of merchandise.

BOSTON, MASS.—At the adjourned annual meeting of the Massachusetts Electric Companies, held Nov. 21, President Abbott, who presided, gave the following information as to occurrences since the annual report was issued: Within the last ten days the lease of the Nashua Company to the Lowell & Suburban Railway Company has been finally approved by the Railroad Commissioners of Massachusetts and New Hampshire. Furthermore, the Railroad Commissioners of Massachusetts have given their assent to the consolidation of the Lowell & Suburban and Lowell, Lawrence & Haverhill. The Railroad Commissioners have also given their assent to the consolidation of the Brockton Company with the South Shore & Boston and West Roxbury & Roslindale companies. The Railroad Commissioners have also given their assent to the issue of 10,160 additional shares of Lynn & Boston stock. In addition to this Lynn & Boston stock, the issue of 2626 shares of Brockton Street Railway stock has been authorized. The stockholders elected the following trustees to serve for the three years next ensuing: S. Endicott Peabody, Everett W. Burdett, E. Rollins Morse, Philip L. Saltonstall and Philip Dexter. Mr. Dexter succeeds S. Reed Anthony, who declined to serve again. The stockholders voted to amend the declaration of trust by changing the time of the annual meeting to the third Wednesday of November.

LOWELL, MASS.—The Lowell, Lawrence & Haverhill Street Railway has increased the wages of its motormen and conductors from 16 cents, 17 cents and 18 cents an hour to 17 cents, 18 cents and 19 cents an hour. The company has also reduced the fare between Nashua and Lowell. The fare between Nashua and Lakeview is now 10 cents, and the fare to Lowell is 15 cents instead of 20 cents.

WAREHAM, MASS.—The Middleboro, Wareham & Buzzards Bay Street Railway Company has at last secured a franchise in Wareham. The company has been over a year in obtaining this right. It has already secured franchise grants in most of the other towns through which it will pass. The line is part of a plan to build an electric railway from Middleboro, where it connects with the New Bedford, Middleboro & Brockton road, to those cities and to all points beyond in Plymouth and Bristol Counties, and to Boston, and also with the East Taunton road to Taunton, Providence and points west, through the southern Plymouth County towns to Falmouth, Hyannis and Chatham in Barnstable County. The present company will build to Buzzards Bay, a distance of 23 miles, passing through South Middleboro, West Wareham, East Rochester, Wareham and Onset Bay.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week, in order to secure insertion in the current issue.

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Consolidation at Wheeling, W. Va.

The consolidation of the Wheeling Railway Company, Citizens' Railway, Moundsville & Wheeling Railway and the Bellaire, Bridgeport & Martins Ferry Railway is announced. The name of the consolidated company is the Wheeling Traction Company, and its incorporators are: A. R. Manning, Henry Ford, A. M. Snyder and L. M. Hildreth, of Cleveland. The financial details are not given. T. B. Condeman, of Philadelphia, is to be president of the company.

Municipalities Can Levy Such Taxes as They Choose in Georgia

The Supreme Court of Georgia has just rendered a most important decision affecting the right of cities to levy a special tax on street railway companies. This opinion is handed down in the case of the Savannah, Thunderbolt & Isle of Hope Railway vs. Mayor and Alderman of the City of Savannah. The city of Savannah levied a tax of $100 per mile on the street railway, or $1,306 for its 13 miles of track. The company refused to pay, and the matter was carried before the Superior Court of Chatham, which held that the tax could be collected. The Supreme Court affirms the decision of the Superior Court.

Purchase of Illinois Road

A special dispatch from Cleveland announces the purchase of the Elgin City, Carpentersville & Aurora Railway by the Cleveland, Western Reserve and American Trust companies, of Cleveland. The road is 31 miles in length, and the purchase price is said to have been $550,000. This purchase give rise to a rumor of a consolidation of the electric lines of northern Illinois and the building of an extensive system. The Cleveland Western Reserve and American Trust companies completed and financed the consolidation of the Southern Ohio electric roads as the Southern Ohio Traction Company.

The Electrification of the London Metropolitan Road

The engineering world is eagerly awaiting the final award of the contract for the electrification of the London Metropolitan District Underground Railway. The contract calls for the relaying of about 50 miles of subterranean railway, and among the contracts competing for the award are the most prominent engineering firms of the United States, England and Germany. It is an international engineering contest. The contract is expected to be awarded by Jan. 1. Among the companies which have submitted bids are: Sprague Electric Company, of New York; Westinghouse Company, of Pittsburgh; General Electric Company, of New York; Dick, Kerr & Company, of London; Mather & Platt, of Manchester; Electric Construction Company, of Wolverhampton; Siemens & Halske Company and Schukert & Company, of Berlin.

Improvements at Knoxville

The announcement was made in the STREET RAILWAY JOURNAL for Dec. 8 that the Knoxville Traction Company had decided to expend $2,000,000 in improvements during the next two years. C. C. Howell, vice-president and general manager of the company, in making a public announcement of the improvements, stated that he had no details to give out, but in a general way said that, during the spring and summer, $150,000 would be spent in improving the property of the Knoxville Traction Company, over and above what the property would take in; about $25,000 or $30,000 upon the Knoxville Electric Light & Power Company's plant, and probably $250,000 or $300,000 would be spent in building a gas and coke plant during the spring and summer. Mr. Howell further stated that he had arranged for and would expend $1,000,000 on another enterprise, which he did not care to say anything about at this time.

Contracts will be made for ties and poles, new rails and new cars, extension of the present car house, and the completion of the car house at the power house just as soon as the plans could be finished, he said.

Maine Franchise Tax

Some time ago an order was introduced in the Portland Council requesting the City Solicitor to give his opinion as to whether or not the franchises of the various street railways operated in Portland were indeterminate, and, if so, how they might be terminated;

also the method to be taken by the city in moving for legislation to provide for taxation of franchises or exacting from the companies a suitable rental for the franchises enjoyed. The solicitor, in giving his opinion, states that the original charters of the street railways are for twenty-five years, with the privilege of renewal for a period not exceeding fifty years at any one time. The franchise of the Portland Street Railroad Company was extended for the fifty-year period in 1886. The street railways pay a State tax of 1.10 per cent per mile on the gross receipts where said gross receipts do not exceed $1,000 per mile, and, for each $1,000 additional gross receipts per mile, an increase of one-tenth of 1 per cent. These State taxes take the place of all municipal taxes, and have been held constitutional by the Supreme Court. In closing his opinion the solicitor states it would be necessary to repeal the present tax law, and substitute a new law, in order to bring about municipal taxation.

Denver Company Appeals Tax Case

The Denver Consolidated Tramway Company has filed an appeal in the tax suit in which an adverse decision was recently handed down by the District Court. The company contended that the valuation of its property should be fixed by the State Board of Equalization, and not by the county assessor. The latter included a tax on the franchise, amounting to over $9,000. The company held that it should be assessed as a railroad, but the court overruled the contention. The attorneys for the county and the company agreed upon an application to the Appellate Court that the case should be disposed of as soon as possible. The company naturally wishes the suit settled as quickly as possible, as the interest on the back taxes, if the final division is adverse, will amount to nearly $1,000 a month. There are five grounds on which the bill of exceptions is based: First, it is alleged that the lower court was in error in sustaining the motion to dissolve the injunction restraining the defendants, the County Board of Commissioners, from selling the company's property for the payment of taxes and in dismissing the complaint; second, in finding that the State Board of Equalization was not the proper authority to assess the company's property; third, in rendering a decree against the plaintiff for the costs; fourth, in examining the articles of incorporation of the company and admitting them as evidence; fifth, in holding that the company is not a railway corporation in the meaning of the revised statutes of the State. The company gave an appeal bond of $100,000.

Street Railway Taxation in Connecticut

The tax returns of the different street railways of Connecticut to the State for the year ending Sept. 30, 1900, show a total amount of $157,451, made up from the following companies:

Hartford Street Railway	$36,624
Danbury & Bethel	2,685
East Hartford & Glastonbury	2,000
Enfield & Longmeadow	933
Fair Haven & Westville	39,998
Hartford, Manchester & Rockville	3,526
Middletown	1,545
Manufacturers	220
New London	3,365
Montville	2,750
Norwich	4,343
People's Tramway	2,840
Stamford	2,112
Torrington & Winchester	1,950
West Shore	940
Winchester Avenue	15,083
South Manchester Light, Power & Tramway Company	100
Bridgeport Traction	23,148
Derby Street Railway	2,505
Meriden Electric	5,758
Norwalk Tramway	4,181
Shelton Street Railway	2,278
Westport & Saugatuck	543
Milford Street Railway	656
Farmington Street Railway	480
Connecticut Lighting & Power Station, New Britain	5,298
Connecticut Lighting & Power Company, Waterbury	7,035
Connecticut Lighting & Power Company, Norwalk	2,120
Meriden, Southington & Compounce Tramway	2,350
Bristol & Plainville	1,553

Changes in Yerkes' Interest

During the past two weeks there have been some very important changes in the management of the properties in which Charles T. Yerkes is interested. D. H. Louderbach has resigned as the London representative of Mr. Yerkes; H. C. Davis has returned from London, where he was in the interests of Mr. Yerkes; Howard Abel has resigned as president of the Lake Street Elevated Railroad, of Chicago, and has been elected to suceed Mr. Louderbach in London, and Charles E. Yerkes has been elected as president of the Lake Street Elevated, to succeed Mr. Abel.

Mr. Louderbach's resignation is ascribed to the failure of the health of his wife. He is still in London, but will return to the United States shortly. Mr. Louderbach has been associated with Mr. Yerkes in all his Chicago enterprises. He supervised the erection of the Union Loop, and also had charge of many of the outlying suburban lines now merged into the Consolidated Traction Company. He was with Mr. Yerkes in London when the latter completed the purchase of the Charing Cross, Euston & Hampstead Railroad, and then returned to the United States when the financial details were completed, only to be selected as the official representative of Mr. Yerkes in London.

Mr. Howard Abel, the successor of Mr. Louderbach in London, has been associated with Mr. Yerkes in his Chicago enterprises for a number of years. He is a young man, thirty-two years of age, and was born in Strensall, Yorkshire, near York, England, Nov. 27, 1868. He was connected with the Northwestern Railway in England, Leeds Forge Company, and was private secretary of the secretary of the latter company. Mr. Abel came to the United States in 1890, and entered the employ of the Fox Solid Pressed Steel Company, at Joliet, Ill. He became associated with Mr. Yerkes in 1893, and has been president of the Lake Street Elevated Railroad, and secretary and treasurer of the Northwestern Elevated and Union Loop, of Chicago.

Charles E. Yerkes, the successor of Mr. Abel at Chicago, is a son of Charles T. Yerkes. He is thirty-seven years of age, and his first business training was obtained in the Philadelphia office of his father in 1882. He remained with his father at Philadelphia for several years. Later he became identified with the Siemens-Halske Electric Company as president, a position he filled for several years, during which he divided his time between New York and Chicago. Mr. Yerkes is a member of the brokerage firm of Dewar & Yerkes, and will not sever his connections with the company because of his election as president of the Lake Street Company.

H. C. Davis is a member of the firm of A. A. Houseman & Company, of New York, and has been identified with the Yerkes' London deal since its inception. He will return to London with Mr. Abel, and will be directly connected with the Charing Cross, Euston & Hampstead Railway.

First Annual Report of the British Westinghouse Company

The first annual meeting of the British Westinghouse Electric and Manufacturing Company, Ltd., was held Nov. 23, at Cannon Street Hotel, London, and was presided over by the Hon. R. Clerc Parsons, M. I. C. E., A. I. E. E., chairman of the executive committee. The annual report showed the sales of the company for the preceding year amounted to £550,000, as compared with £266,528 during the preceding year. During October, 1900, the sales were £32,550, and up to Nov. 22 the November sales amounted to £31,890. The profit for the year was £10,777.

The chairman explained that while there had been some delays on the work of constructing the factory at Manchester, the work was being pushed forward as rapidly as possible. These works will have a staff of from 3000 to 5000 men. The main shop will cover eight acres, and will be devoted to electrical machinery. Another shop will be devoted to the manufacture of gas engines, and another to steam engines. The chairman then referred to the proposed equipment of the Metropolitan and Metropolitan District lines as follows:

"In considering this complicated matter it occurred to us frequently that, in order to assist those companies to carry out the transition from steam locomotion to electric locomotion, various requirements in the shape of parliamentary powers were absolutely necessary. Within the last two months those companies—the Metropolitan District and Metropolitan Railway—have issued invitations to the leading manufacturers of electrical machinery asking for schemes to be submitted for carrying out this great work. We have given this matter our most careful attention, and, in order

to submit as complete a proposal to those companies as possible, it was found to be absolutely necessary to apply to Parliament for powers for doing certain things in connection with the running of those railways. Those powers which we have asked for consist in this—that we shall present a proposal to supply the entire outfit of electrical machinery, rolling stock, etc., of those companies at a given figure; that the payment for this work would be either in the shape of Lloyd's bonds, which carry a first lien upon a company's property. These bonds would be issued to the contracting parties on the certificate of the engineers of the railways, and these bonds would be negotiated by this company in any way they might think fit. Another proposal which we intend to submit, and for which we have asked Parliament to sanction powers, is to lease the sites for the generating stations, for which those companies have secured parliamentary powers; to erect on those sites the necessary generating stations; to lay the necessary conductors to the lines in question; to supply the rolling stock, and all that is necessary for carrying on the traffic; that we should receive from those companies something in the shape of a guarantee upon the receipts of those companies; and this would be, practically, in the form of a contract with those companies, not interfering in any way with the preference, debenture, or any other shareholders, of which there are a large number. Our sole object in presenting this application to Parliament was with the view of giving those companies, if they thought fit to entrust us with the contract for the electrification of these railways, to be able, and be in a position, to carry out that contract without hindrance and delay."

Development of the Zurich Tramways

United States Consul Lieberknecht, writing from Zurich, under date of Nov. 1, says:

"Most of the street railways of Zurich are owned by the municipality, and it is only a question of time when the few private lines still holding franchises will also be under the control of the city officials. Municipal ownership of street railways is gaining ground greatly in Europe.

"The fare in Zurich is to-day 2.5 cents, when buying the tickets in block books, but will within the course of a few years be lowered to 2 cents. It is remarkable that the city can run the street railways so cheaply, considering the expensive and solid way in which the tram lines are constructed and the high price of soft coal, which costs from $6.37 to $7.72 per ton, delivered at the power station.

"During the years 1898-1900, the city of Zurich has changed its horse car lines into electric lines with the overhead trolley system, and also largely extended the mileage. The total length of track is now 25 miles, and the number of cars 150, of which forty are trailers. The electric lines have all been constructed by J. Sigfrid Edström, a Swedish engineer, who received his technical education in the United States. Mr. Edström, upon his arrival in Switzerland, found the electric street car lines in a very bad state, in consequence of using inferior material. In rebuilding and extending the tramways of Zurich, Mr. Edström did his best to introduce American street railway material. In buying the rails, however, he found that, owing to difficulties in the ocean transport, the American rails could be had only in lengths of 30 ft., while 60-ft. rails were desired. As rails of this length could not be had on the Continent, it was finally decided to use Phœnix girder rails (German) of 40-ft. length. Without doubt, the American manufacturer of steel rails would have a great field for his overproduction if rails of greater length could be shipped across the ocean.

"The electric rail bonds used in Zurich are from a New York firm. One of the new lines has been built with cast-welded joints without any electric bonds. The track itself is laid very securely on heavy stone or concrete foundations. The overhead trolley wire is generally fastened to the houses, a special sound breaker being used to avoid the transmission of noises into the house. This arrangement is very satisfactory from an æsthetic point of view, as there are very few poles in the streets. Where houses could not be used, the wires are fastened to tubular steel poles of German origin, solidly fastened in concrete foundations. Many of these posts also serve as poles for gas or electric lamps.

"The cars were built by two Swiss factories, but with Peckham (New York) trucks. The street car motors and controllers are all of American manufacture.

"The underground cables, as well as the electric generators, the steam engines, and the switchboard, are from Swiss factories. Several machines of American make are used in the repair shop.

"Mr. Edström, the engineer in charge, has recently accepted a position as director of the tramways of Gothenburg, Sweden, where extensive construction of electric street car lines will take place within the near future."

Annual Meeting of the Engine Builders' Association of the United States

The annual meeting of the Engine Builders' Association of the United States was held at New York, Dec. 4. Prof. John A. Sweet, the retiring president, in his address set forth the objects of the association as follows:

"The promotion of the interest of the engine trade by the advancement of engineering knowledge and practice, by the cultivation of mutual respect and acquaintance and the maintenance of a high professional standard among members; comparing and standardizing methods promoting economy in operation, and the advancement in general of the interests of the trade as a whole."

Three papers were read before the association; one by H. C. Ebert, of the Westinghouse Electric & Manufacturing Company, on "Inter-relations Between Engine and Generator Builders in Connection with Engine Type Units for Power Purposes"; another by E. T. Armstrong, of the Ball Engine Company, on "Economy Guarantees of High Speed Simple Engines," and a third by H. G. Reist, of the General Electric Company, on "Some of the Requisites of Modern Lighting Generator Sets."

Mr. Ball reported to the association as a member of the committee appointed by the American Society of Mechanical Engineers on the subject of standarization, that a meeting of the committee had just been held and progress reported. The committee asked that no action be taken at the present time, and that no standards be adopted until the A. S. M. E. committee had an opportunity of meeting and discussing the matter with the committee appointed by the American Institute of Electrical Engineers on the same subject, as the standards suggested by the A. S. M. E. did not entirely agree with the suggestions which they understood the committee of the A. I. E. E. has considered advisable. Continuing, he said, the object is to find out what has been done in the past and render the practice uniform as far as possible. It was probable that two standards for the size of the shaft will be necessary, one for center and one for side-crank engines. The two committees agreed on the subject of speeds, and at present would not take up alternating-current generating sets.

Most electrical companies use one size of armature, thus doing away with the necessity for sleeves, nuts, etc. The committee asked if the association considered one or two standard sizes for shafting desirable. The most serious difficulty seemed to be in the length of the shaft between the center of the engine to the outer bearing.

Two types of generators were in use, one parted horizontally and the other vertically, thus necessitating two styles of bases for dynamos. Possibly one style of base might be made, having the plane low enough for one type, and stools used, either cast into the base or bolted to it for the other type.

Mr. Ball asked that Mr. Sweet should attend a conference between the two committees to be held the next day. Mr. Ames, in behalf of the society, thanked the committee for its work.

Mr. Wood asked Mr. Ebert what suggestions he could make for the engine man to follow in order to meet the requirements of the electrical manufacturer. Mr. Ebert suggested that they should get together at the start instead of finding changes necessary after the customer had received the generating sets, and had discovered that the engine and the dynamo did not agree. He said he believed that consulting engineers were largely to blame for making requirements which were sometimes altogether unreasonable.

Mr. Bird spoke on the subject of the pressing on of the armatures. He said that it was a great inconvenience, that it was not always understood who should do the work. That in their plant (Ball & Wood Company) they now bore a hole in the end of the shaft of a uniform size and use a stud bolt to insure the fit. Mr. Ebert approved this practice and suggested that the electrical manufacturers would welcome it becoming general.

Mr. Palmeter discussed the question of overhead capacity, the subject of the length of the shaft and the height of the base. Mr. Ball stated that the height of the base would probably soon be settled now, and that the General Electric Company was already meeting this question, but that the overload capacity was a serious matter. If too much is asked, the plant becomes unnecessarily costly, and frequently prevents a man investing because of the initial cost. The electrical engineer was largely to blame for this in encouraging a man to ask for too large an overload capacity as compared to his actual needs, and Mr. Ball suggested that there should be a limit placed on the overload capacity to be called for. Mr. Ebert

stated that that would probably adjust itself, that the Westinghouse Company now would not agree to over 50 per cent overload capacity, and is now doing all it can to keep down the demand for excessive overload capacity. Mr. Gates said that the engine builders would gladly join the electrical manufacturers in that move.

Mr. Stett suggested that it would be well for dynamo builders to specify more exactly what would be required of the engine in regard to the speed variation in each case.

Colonel Dick said that when the dynamo first came into use electricity was regarded as an "occult science." Men entirely ignorant of electrical subjects were put on the road and made propositions, which the purchaser, knowing very little if any more than the seller about the subject, accepted as necessary, and which the engine man had to meet, no matter how absurd. Fortunately that condition has passed now, and the engine builder and the dynamo builder are gradually coming closer together. The engine builder and electrical men should have a standard that all could agree upon, and that would set aside unreasonable demands.

Mr. Stett brought up the question of getting plans more promptly from the electrical manufacturers so that the engine builders could have more time on their work. Mr. Ebert said that if no special designs were called for plans could be quickly given, but so many special machines had to be built, and they naturally were hindrances to getting out plans promptly. Mr. Reist suggested that a standard of units should be adopted.

Mr. Wood made a motion that the committee from this association should meet the committee of the other associations concerned and take this matter up thoroughly, as the question was one of great importance, and one which should be decided as soon as possible for the mutual benefit of both the engine builder and the dynamo builder.

At the end of the executive session William M. Taylor, of the Chandler & Taylor Company, extended an invitation to the association to hold their next annual meeting at Indianapolis, which invitation was accepted. In the evening a dinner was served at Sherry's, at which some thirty-five members and guests were present.

London Letter

[*From Our Regular Correspondent.*]

London is at present full of interesting opportunities for electrical investments, a number of new underground and surface electric railways being now far enough along to give the directors a chance of offering their stock for publication. Among the most important surface schemes is the excellent system that J. Clifton Robinson has been identified with so long, and under whose skilful guidance has become the most important system in the vicinity of London. During the last session of Parliament many very valuable extensions were granted to them, and as much of the electric equipment is already completed the company is now offering for public subscription an issue of £350,000 4 per cent first mortgage debenture stock, of which £34,125 is reserved for allotment to the holders of existing debentures, and the remaining £315,875 is now offered for public subscription at par. The company, which was incorporated in 1894, is authorized to establish a system of electric tramways in the western districts of London, embracing the territory bounded cityward by Hammersmith, Broadway and Shepherd's Bush respectively, and extending westward by the main roads to Uxbridge, to Hounslow, and to Hampton Court. The mileage of these electric lines amounts to 38 miles of route and 74 miles of single track. Under the company's acts and orders, the periods to elapse before the local authorities have an option of purchasing the lines are, as to 12 miles twenty-five years, 17½ miles twenty-three and a half years, 4½ miles nineteen and a half years, and 4¼ miles nine and a quarter years, giving a general average of about twenty-two years. In case of purchase, the local authorities would, as to 22 miles, pay the market value as a going concern, and as to the remainder tramways act terms. The company's central power station at Chiswick, now rapidly approaching completion, is one of the finest tramway traction stations in the kingdom, and has been designed to accommodate all the generating machinery which will be needed for the entire system of 38 miles. The first portion of the scheme to be carried out comprises 16 miles of route, of which 11 miles have already been completed, and are about to be put into operation electrically; the remaining 5 miles are in course of construction, and should be opened for traffic in the ensuing summer. When this portion, with the power station, depots and equipment comprised in the security for the first mortgage debenture stockholders, has been completed, the undertaking of the company will have involved a capital outlay estimated at over £800,000, and of this amount the outlay to the present time has been over £500,000. The cost of property in real estate, depots, power station, and fixed plant, apart from the value of the tramways and rolling stock, will exceed the amount of the present issue. The company has had in successful operation for the past six years 9 miles of tramways (including 1¾ miles between Kew Bridge and Richmond, for which authority to use electricity has not yet been obtained), and, although worked under all the disadvantages of horse traction, the profits have enabled the company to pay dividends upon its ordinary capital of 8 per cent per annum for the first four years, and 10 per cent per annum for the last two years.

The Baker Street & Waterloo Railway Company, one of the new underground electric railways, which will join the immense southern terminus at Waterloo, with many most important centers of traffic in the West End and northwest of London, is also making satisfactory progress, and it has just opened its subscription list to the public. The share capital is £2,385,000 in 66,000 4 per cent preference shares, and 172,500 ordinary shares at £10 each, interest at 3 per cent being paid during construction. The directors of the company are: Theodore Julius Hare, chairman; the Marquiss of Dufferin and Ava, K. P., G. C. B., G. C. M. G., etc.; Quintin Hogg, Major-General C. S. Hutchinson, C. B., late R. E.; the Right Hon. Sir Algernon West, K. C. B.; and the engineers are, Sir Benjamin Baker, K. C. B.; W. R. Galbraith, C. E.; R. F. Church, C. E.

Sir Benjamin Baker, it will be remembered, was also the engineer for the Central London Railway, which has achieved such marked success since it was opened three months ago. As we have not previously published much with regard to this most important enterprise, we give the following facts, which are taken from the company's prospectus:

The Baker Street & Waterloo Railway, as authorized, is about 5 miles in length, and will be formed by the construction of two separate parallel tunnels throughout its entire length, on the Greathead system. Starting at the Elephant and Castle, on the south, it passes Waterloo station, thence under the river, up Northumberland Avenue, Charing Cross, the Haymarket, Regent Street, Portland Place, Regent's Park, Baker Street, Marylebone station (the terminus of the Great Central Railway), and Edgeware Road, to Paddington station. The site for the necessary depot and generating station is about a quarter of a mile to the south of Waterloo station.

A large portion of the land required has been already purchased, and satisfactory arrangements have been concluded for the greater part of the remainder.

They are being constructed by Perry & Company, the well known firm of contractors, who have carried out large and important works for the London and Southwestern Railway and other companies, are in full operation, and this section will be completed and opened for traffic independently of the rest of the line. The motive power will be electricity.

The speed of the trains will be about 13 miles an hour, including stoppages. The entire distance between the Elephant and Castle and Paddington will be accomplished in about twenty-five minutes, as against about an hour-and-a-quarter by omnibus. There is no direct through competition by any railway or tramway with this line. From statistics prepared by the London County Council, it appears that the Elephant and Castle is the second largest point of concentration of passenger traffic in London, the next largest is Charing Cross, thePiccadilly Circus, then Oxford Circus, so that it will be seen that this line will soon be one of the largest centers of traffic in London. Unlike the railways running east and west, which carry chiefly a morning and evening traffic, this line, running as it does, through the most important shopping districts in London, and near to the government offices, clubs, large hotels and many theaters and other places of amusement, as well as serving important business centers, and also tapping one of the most densely populated artisan districts in London, will doubtless carry a large and continuous traffic throughout the day and a great part of the night.

The engineers of the company estimate that the total working expenses of the line, allowing for 300 trains each way on week days and 150 trains each way on Sundays, may be taken at £100,000 a year. On the basis of the results of the Central London Railway, which has been open for several months, with an increasing traffic, the directors consider a moderate estimate of the annual receipts to be:

Passenger traffic	£260,000
Parcels, advertisements, etc.	10,000
Total gross receipts	£270,000
Deduct working expenses	100,000
Net revenue	£170,000
Interest on £794,000 4 per cent debenture stock	31,760
Balance available for dividends	£138,240

More than sufficient to pay dividends of 4 per cent on the preference and 6 per cent on the ordinary shares.

The company has entered into contracts with the London & Globe Finance Corporation, Ltd., for the acquisition of the necessary land, the construction of the works, and the equipment of the railway with all its appurtenances, including working plant and sufficient rolling stock for a three-minute service, complete in all respects as authorized by the company's acts, to the satisfaction of the Board of Trade and of the company's engineers, for the sum of £3,096,000, payable as to £2,322,500 in cash or shares, and £773,500 in debenture stock bearing 4 per cent interest. The corporation undertakes all risks and contingencies of every kind in connection with the construction of the railway and works; it will provide for all Parliamentary, legal, engineering, administration and other expenses whatsoever during construction; will maintain the line for one year after its opening for public traffic, and will pay to the company the sum of £50,000 for working capital. In addition to this sum there will be available for the general purposes of the company £83,000 from the authorized capital unappropriated. Payments will be made to the contractors on the certificates of the company's engineers. The London & Globe Finance Corporation has disbursed to date in regard to the railway the sum of £654,705 10s. 7d.

The success of the Central London Railway and the City & South London have undoubtedly stimulated interest in the other projects which are on foot to honeycomb London underground in all directions. During the recent festivities in London, on the occasion of the return of the C. I. V., it is stated that the Central London in one day carried 250,000 passengers, so that the companies operating other schemes are making the most of the times. The City & South London Company has completed its extension from the Bank Station to Moorgate Street, and is now busily engaged upon the projected further extension of the line to the Angel, Islington. The Great Northern & City Line, which will run from Finsbury Pavement to Finsbury Park, and probably further north, is making good progress, though we understand that no decision as to electrical apparatus has yet been made. A shaft has been sunk near the New North Road by the side of the Regent's Canal, and the work of tunneling has been proceeding toward both termini. About 1½ miles of single tunneling has been completed, and the progress is at the rate of about 43 ft. weekly. The shaft at New North Road will not be used as a station for passengers, but as a generating center for the whole line. It is conveniently placed by the side of the canal, and supplies can readily and cheaply be brought up. There will be four stations on the route, viz., Finsbury Pavement, Old Street, Essex Road, and Drayton Park. The size of the tubes will differ from those on the Central London Electric, inasmuch as they will be built so as to receive the carriages of the Great Northern Railway, with which system it will effect a junction. The line will, in effect, be a city feeder to the Great Northern Company's system. The tubes will be some 16 ft. in diameter. Besides running the carriages of the Great Northern line through from Finsbury Park to Finsbury Pavement and beyond, there is a further project of running smaller carriages, as on the Central Electric, for the convenience of their own passengers who do not require to be taken further than Drayton Park.

I have already referred to the Baker Street & Waterloo as regards its prospectus, which shows that material progress is being made, and capitalists are now at work organizing a new underground electric scheme, which will fill a long felt want, namely from the Bank, paralleling Queen Victoria Street, the Strand, Fleet Street, Piccadilly, and so on West to Hammersmith. In the meantime the Metropolitan and District Railway Companies have fixed Dec. 1 for the receipt of tenders from the various electric traction firms, which have been invited to submit tenders for the conversion of the Inner Circle from steam to electricity. Whether this is feasible or not is a much mooted point, chiefly owing to the expense. The electric installation could not cost much less than £500,000, and probably a similar sum would have to be expended on the whole underground tunnel structure to put it into first-class condition, as it is reported that the action of the gases on the iron has put the tunnel into such a condition that much costly repairs would be necessary. As the companies have never paid satisfactory dividends, it is not thought that financiers look upon the investment very favorably. It is to be hoped that some way will be found out to accomplish the object, as the conversion from steam to electricity of this system in these enlightened days has now become an imperative necessity.

Relating to the Charing Cross & Hampstead Railway, the new underground project, which was recently purchased outright by Mr. Yerkes, the following particulars will be found interesting: hoped that it may be finished in two years. The power station for generating the electricity which will provide the motive power The work will probably be begun in February next, and it is will be at Highgate Road. There will be two sets of lines, one starting from High Street, Hampstead, and running down under Haverstock Hill, and the other from a station adjoining that of the Midland Railway at Kentish Town. They will unite at High Street, Camden Town, and run to Euston Station. The line will then go under Tottenham Court Road to a station connected with the Central London Company's at Oxford Street, and thence to Charing Cross, thus linking together the Midland, London & Northwestern, Central London, and South Eastern Railways. The trains are to be worked on the "multiple unit" system, each carrying its own motor underneath, so that there will be no engines. There will be an all-night service, and during the busy portions of the day trains will run every two and one-half minutes.

One of the most important contracts that has lately been placed is that for the electric equipment of the tramways of Durban, Natal, a city which has recently become so well known. Hubert, Davies & Spain, of Durban and Johannesburg, have secured the contract for laying the track at the price of £38,000, while Macartney & McElroy, of London, have secured the contract for the overhead equipment for £16,994 10s. 10d., and also the contract for the cars at £18,600. The contract for the power house and generating plant was secured by Dick, Kerr & Company, of London, for £26,240 10s. The contracts were not secured by the lowest tenderers, the Municipal Council taking into consideration the power of completion to time and other matters. As usual, interesting facts are disclosed by a comparison of the several tenders. The lowest tender for the overhead equipment was that of Reunert & Lenz, Durban and Johannesburg, which amounted to £16,427 14s. 3d., and the highest that of Willing Brothers, Ltd., London, for £125,368. The lowest tender for the cars was that of Lowden Brothers, Dundee, for £15,905, and the highest that of Willing Brothers, Ltd., London, for £26,300. For the generating plant the lowest tender was that of R. W. Blackwell & Company, Ltd., London, at £20,417 10s., as compared with alternative tenders submitted by Hubert, Davies & Spain, Durban, of £24,010 and £30,723 10s.

For the overhead work the specifications stipulated for steel poles and cast-iron bases, with wrought-iron brackets at the top. Where the track is doubled on the main line, center poles with ornamental bracket arms are to be used. On the single track section the span-wire system is to be employed. The cars are of the double-decked, four-wheeled pattern, with seating capacity for twenty persons on the lower deck, and thirty on the upper. Wide curves on the trackway being the rule, enables the adoption of a 7-ft. wheel base. The car body is 26½ ft. long by 8 ft. 2 in. broad. There are no footboards, but a platform at each end. There is a central gangway on each deck, between pairs of turn-over seats, made to accommodate two persons each. The cars are to be elegantly decorated with embossed molded cornices, plate glass mirrors, etc., and each fitted with signal bells and ten 16-cp glow lamps. The sides are specially made with the upper structure open for hot weather, with roller sunblinds, canvas rain curtains, and glazed fanlights and doors, and an awning is provided on the upper deck for protection against the sun and rain. American trucks and electrical apparatus are required; but the car bodies may be either of English, Canadian or American construction, in the option of the Council. The number of cars in the contract is twenty-two, which are to be landed complete and ready for use.

The contract for the generating plant stipulated for three 400-ihp compound engines, working up to 600 hp; three large dynamos, and three boilers—all of English manufacture. Cooling and condensing apparatus are also included. The plant is to be erected and maintained by the contractors for three months.

A. C. S.

Notes from Germany

[*From Our Regular Correspondent.*]

A compilation of the traffic density on street railways in some of the principal European cities is certainly interesting. The number of car-km occurring on one day over 1 km of track during 1899 was: In Berlin (length 268 km), 523; in Vienna (80 km), 740; in Hamburg (123.7 km), 588; in Dresden (104 km), 433. The number of average yearly rides per inhabitant was: In Vienna, 57; in Berlin, 90; in Buda-Pest, 92; in Hamburg, 131; in Dresden, 162 (including transfers). The number of cars per km of track in Berlin was 7.5; in Vienna, 11; in Buda-Pest, 6; in Hamburg, 5.5; in Dresden, 6. Of the cars in daily use there are the following per day and per km: In Berlin, 4; Vienna, 7.6; Buda-Pest, 4; Hamburg, 4.5; Dresden, 3.8. During the year 1899 the largest number of

car-km per day and km occurred in Vienna, but the yearly rides per inhabitant are smaller in number in Vienna than in the other cities mentioned.

The Building & Operating Company of Municipal Railroads, of Vienna, has issued its first orders to motormen and conductors. The hours of work per day, unless otherwise ordered by legislation, are to be twelve. The following time is counted as working time: One-quarter of an hour before starting on the first trip, one hour for meals, between 10 a. m. and 2 p. m., and one-quarter of an hour when returning from the last trip. Besides, if employees or substitutes have to work later than 6 p. m. a quarter of an hour is given them for supper. It is understood, however, that if the occasion demands it, the men must work as long as fourteen hours per day, the extra time to be paid for, and, in case of extreme emergency, even longer than fourteen hours. After uninterrupted service of six days, each employee is given one day leave of absence, for which he receives full pay.

The electric service on the Wannseebahn has been opened to the public. Until further notice a complete train will make six trips daily between Berlin and Zeblendorf. As the fact was not advertised, the regular commuters were somewhat surprised upon entering the train to find that there was no locomotive, but apparently the train moved along without it.

The Freie Vereinigung der Strassenbahn-Betriebsleiter Rheinlands, Westfalen's und der Benachbarten Bezirke, held its forty-fifth meeting at Frankfurt-a.-M., on Oct. 25. The following was the programme:

1. Remarks on the "Maintenance of Electric Motor Cars," by Director Geyl, Frankfurt.
2. "Heating of Electric Motor Cars," by Mr. Gunderloch, Elberfeld.
3. "Current Consumption on Single and Double Motor Cars," by Dr. Kollmann, Frankfurt.
4. "What are the Greatest Permissible Grades and Lengths of Grades for Electric Roads Using Trailers?" by Dr. Kollmann, Frankfurt.
5. Remarks about pressed axle bearings on street cars, as well as the latest improvements in oiling and enclosing devices on the same, by Royal Railway Director Sürth.
6. "Experiments on the Behavior of Tracks on Concrete Foundation," by Mr. Kurz.
7. "What is the Practical Result of Running Workingmen's Trains on Electric Lines?" by Mr. Battes.
8. "Are Time-tables with a Map of the System Printed Thereon Commendable?" by Dr. Kollmann.
9. Association business, choice of place and date of next meeting.

The above papers were thoroughly discussed. At 2 p. m. the delegates met at a dinner, and at 4 p. m. the new plant of the local system was inspected. The delegates also visited an exhibition of railway apparatus set up by the world-renowned Georgs-Marien Bergwerks und Hütten Verein, of Osnabrück.

The first trial trips on the Siemens & Halske electric elevated road in Berlin have been made on a portion of the road 5 km in length. The trips are being continued with two cars, loaded with small stones, at a speed exceeding that of the trains of the city line. The roadbed, which is laid with broken stone, and extends over the entire distance now completed, is expected to dampen the noise considerably. Everyone is anxious to see whether this object has been attained. A comparatively noiseless and jarless riding is expected, however, on account of the use of the lap joint (Halbstoss).

The city of Berlin is in hard luck. As is known, the municipality in expressing itself so favorably to the private companies by extending their franchises, also decided to build and operate its own street railways in the future. A plan had been worked out which contemplated the laying of 50 km of double track in those streets not already traversed by the Grosse Berliner Strassenbahn, and the city had asked the government for a franchise. The following reply was received: "In accordance with an agreement made with the municipality some time ago, which is uniform for all street railways, the building and operating of a new street railway line will only be permitted when the public interests demand the establishment of such a road. If the same is not demanded by local conditions, the line will be considered as a nuisance on the public highways and streets. It is, therefore, unwise to grant the franchise for the 50-km road which has been planned without regard to the existing lines. Only such roads will receive a franchise which can be proven to be a public necessity." The city authorities, of course, are in mourning, as they announced their intentions with great *eclat*, and now find that but few small road franchises will be granted to them in the future, as the Grosse Berliner Strassenbahn fairly well supplies the public wants.

In consequence of the requirement of the government to the Grosse Berliner Strassenbahn to abolish the accumulator service within a short time, the Berlin City authorities have raised objections, as in a recent agreement with the company it was decided that the latter should pay the city for the privilege of using the streets 8 per cent of the gross receipts. On account of using more street space for poles, conduits, etc., in the future, the city demanded 10 per cent instead of 8 per cent of the gross receipts. This extra 2 per cent would amount to about M.500,000. The company deemed this too large, and offered to pay M.10,000 yearly, a sum which would have to be paid to the government if the road were a State road. The city deputation further demanded that the company pay the extra expenses which will be incurred by the city in building its underground road through the streets where the surface conduit road will run, as the former will have to be built ¾ in. lower than was originally intended. The portion of the road where both roads would run (if the underground road will ever become a reality) is about 2 km in length, and to lower the tunnel, as stated above, would cost millions. Again, the city and company are at odds, and the damage suit will be taken to the higher courts, which have heretofore shown a friendly attitude toward the company.

During the month of July nine persons were killed by the cars of the Berlin street car lines in Berlin and vicinity, three on one day, and thirteen were seriously injured. In August seven persons were killed and fifteen were seriously injured. In September four were killed and sixteen were seriously injured, making a total of twenty-one deaths and forty-four seriously injured, a number of which died from their injuries.

Many remedies have been tried without success to avoid the damages which the heavy electric cars are exerting on the asphalt pavements. Lately, however, a new method has been applied in Berlin, from which good results are expected. While up to now the rails have been laid directly on a sub-base of concrete, and were in immediate contact with the asphalt, on the trial road they will be laid on base of rough broken stone, and there will be a row on the sides of strips of hard wood. For it has been shown that the best resistance medium to the weight of heavy electric cars is afforded by the ordinary block pavement, which is laid, not on concrete, but on a bed of stones. This bed, it is assumed, gives the rails a chance to sag or spread a trifle as the car passes over them. This is not the case with a bed of concrete, and the result is that when the gage of the car is a trifle larger or smaller than the track gage, the adjoining asphalt pavement receives a severe shock when the car passes over the rail, which in time will destroy the pavement. It is expected that these shocks will be transmitted downward with the new pavement. It is also hoped that the noise will be dampened considerably, as cars passing over tracks laid on block pavements make less noise than those in asphalt pavement. The experiment is of especial interest for Berlin, where a large number of streets have been asphalted recently without regard to the street railways. Besides, the maintenance of these pavements, demanding the tearing up of the streets, are a source of constant trouble to the city and company, and an annoyance to the public. Other cities have taken into consideration the laying of new pavements whether the same is suitable for the laying therein of street railway tracks.

A novel, and for both sides an agreeable and practical form of municipal street railway management, has been adopted by the city of Brünn in Austria. The city has organized, in conjunction with the Union Elektricitäts-Gesellschaft, an offspring from the General Electric Company, of America, a company which is to build and operate the street railways in and around Brünn. In this way the city retains its ownership, and private operation is secured. The capital of the company is 6,200,000 kronen, divided into 31,000 200 kronen shares. The city only retained 200 shares. Some of the franchise conditions are as follows: The maximum speed within city limits is 12 km, outside of the city 16 km, if the road runs along a public highway. On its own roadbed a speed of 25 km per hour is permitted. The overhead trolley system will be used, and the pressure with direct current is to be 500 volts, and not over 250 volts with alternating current. (Direct current will be used.) The rolling stock will consist of forty-one two-axle motor cars, each having two motors, of 37 hp each, seating at least thirty-four persons, and twelve two-axle trailers, seating twenty-eight persons. All apparatus, including wires, motors, etc., are to be bought and manufactured in Austria. In the latter country this clause is now so frequently inserted that foreign manufacturers have very little chance to do any business there.

Sooner than was anticipated, the cities operating their own roads are confronted by the problem whether it is advisable for them to build the suburban roads, that is on territory which is outside of their city limits, or whether they had better have private companies build such roads. This question was not considered by the authorities at the time when small street railway lines could be

very cheaply bought, for they now find that with the lines they undertook the obligation to spend millions for the construction of roads which would be perhaps unprofitable for a number of years, and extended far out of their own and into the limits of other towns. This question of serving the suburban districts will probably determine the much larger question whether cities can be efficient street railway managers. This will show whether they acquired the road for the public good, in order to extend the system, or whether they bought it as a gold mine, which promised returns and brought with it no obligations.

The conditions of Frankfurt-a.-M. has brought this question to the front. The city expended M.25,000,000 for the purchase and electrical equipment of the road and the building of a power house. In order to meet competition and derive all the benefits possible the city was forced to apply for all the franchises asked for by private companies for the building of suburban roads, which involves considerable money. The authorities have now decided to take the consequences of their decision to operate the street railway lines themselves, and have adopted the following resolutions:

1. The city will be the owner of the franchise, builder, owner and operator of all street railways within the city limits. Roads to be built outside of city limits may be built by private companies or by the city in conjunction with the towns benefited by such roads.

2. These outside roads must be joined to the city lines wherever it is possible. For the regulation of through traffic the city will make agreements with the private company.

3. The suburban roads should be built on their own roadbeds wherever this can be done. This will be considered in the laying out of roads closely bordering on the city limits.

4. Municipal suburban roads will be built as soon as traffic conditions demand it.

5. The first large road which it is proposed to build in conjunction with a private company is the one leading to Hamburg, where the Dowager Empress Frederick resides.

Annual Report of the Brooklyn Rapid Transit Company

The official annual report of the Brooklyn Rapid Transit Company, supplementing the preliminary statement issued several months ago, and which was given in the STREET RAILWAY JOURNAL at that time, has just been made public. The report of the company is for the year ending June 30, and, in presenting it, President Rossiter, of the company, says: "The general result of the business of the system comprising the Brooklyn Rapid Transit Company and constituent companies, for the fiscal year ended June 30, 1900, showed gross earnings from passengers, freight, mail and express, advertising, rents, and miscellaneous income of $11,768,550; expenses of $7,106,373; net earnings of $4,662,177; fixed charges and taxes of $4,135,405, yielding a surplus of $526,772. Adding to this the surplus of June 30, 1899, $96,654, gives a total surplus on June 30, 1900, of $623,426.

"The fiscal year opened inauspiciously with a strike, declared on July 16, the effect of which, though the actual operation of the cars was interfered with but for a brief period, was, nevertheless, far-reaching, and was reflected in receipts and operating expenses for several months thereafter.

"Progress has been steadily made throughout the year in developing plans outlined in the previous year's report for the general improvement of the property. Upon the elevated lines 13.23 miles of new steel rails (1,646 tons) have been laid, and a considerable portion of the floor system and guard timbers renewed, while several miles of safety walk and guard handrail have been constructed. There has also been installed on the elevated lines 32.29 miles of third-rail conductor, and electricity substituted for oil and gas in lighting of all stations.

"Large additions have been made during the year to the equipment of the surface lines, including 330 open car bodies and trucks, 250 closed car bodies and trucks, 1652 motors and controllers, and five snow plows. To the elevated equipment has been added during the year twenty-five cars and trucks, forty-eight motors and controllers, and a considerable sum expended in the electrical equipment of cars.

"There are owned by the various companies some fifty-two separate parcels of land not required for railway purposes, many of these having buildings thereon, with an aggregate value of, approximately, $1,800,000. The assessed value of these combined properties on the last assessment roll amounted to $1,561,800. Sales of this property are being made from time to time, the proceeds being applicable for improvements and betterments. The funds thus realized do not, of course, increase interest or fixed charges, while the disposition of needless real estate actually reduces the items of taxes and realty maintenance.

"Each fiscal year since the inauguration of the Brooklyn Rapid Transit system has seen a considerable extension of track mileage, naturally yielding increased earnings; but notwithstanding the fact that less than 2 miles of new track was added during the fiscal year ended June 30, 1900, and the car mileage reduced 1,600,000 car miles, as shown by the auditor's report, operation for the year resulted in largely increased passenger earnings.

"During the fiscal year your company has paid directly and indirectly in city and State taxes and through free transportation of policemen and firemen over $1,000,000, or about 9 per cent of its gross earnings, and is the largest single taxpayer in the Borough of Brooklyn. The taxes, direct and indirect, paid by the company represent about $2,900 of earnings for each day in the year.

"To the 8076 employees upon its payrolls at the close of the year your company has paid in salaries and wages $4,691,878.50.

"There was paid during the year in the settlement of negligence claims $797,789.91, or 6¾ per cent of the gross receipts, and in addition, for legal expenses in connection with negligence claims, the sum of $106,068.06, making a total of $903,857.97. Your company has pursued the policy of not taking into court actions which should and could be compromised, and the wisdom of this policy is shown by the fact that out of the 565 actions disposed of in court during the year, 407, or over 72 per cent, were victories for the company. Notwithstanding this success, however, suits multiply, and the evils with which we are obliged to contend in negligence litigation are sufficiently great to demand rebuke from the courts and self-respecting members of the bar.

"For all damages for which your company is responsible, it expects to make ample compensation, and it is sparing no efforts to reduce to a minimum the necessity for such expenditure; but against the scandalous attempts of unscrupulous attorneys to mulct the company by the prosecution of fraudulent suits, your company needs and asks the co-operation and assistance of the courts and the public. The evils which exist are a menace to justice, and taint the good name of an honorable profession.

"Well considered plans for further relief of the existing congestion on the Brooklyn Bridge during the commission hours are awaiting indorsement by the Bridge authorities, and will, it is confidently hoped, result in largely improved facilities for handling the traffic on that structure, and inure greatly to the convenience of the traveling public."

Following is a statement of Brooklyn Rapid Transit and constitutent companies for years ending June 30, 1900 and 1899:

Receipts	1899	1900
Passengers	$10,793,984	$11,206,716
Freight, mail and express	36,791	61,305
Advertising	109,487	108,783
Rents	140,811	167,253
Other miscellaneous income	234,960	224,493
Total	$11,316,033	$11,768,550
EXPENSES		
Maintenance of way	$374,947	$415,720
Maintenance of equipment	983,216	882,183
Operation of power plant	948,749	964,665
General expenses	582,175	494,530
Operation of cars	3,593,367	3,551,476
Damages	738,837	797,790
Total	$7,221,291	$7,106,373
Net earnings	$4,094,742	$4,662,177
DEDUCTIONS		
Taxes	$6,636,635	$736,721
Net fixed charges	3,659,988	3,398,684
Total	$4,296,623	$4,135,405
Surplus or deficit	(D)201,881	(S)526,772
Surplus June 30, 1899		96,654
Total surplus June 30, 1900		$623,426

The condensed balance sheet for all companies June 30, 1900, shows the following:

ASSETS	
Cost of road and equipment	$85,984,973.47
Additions and betterments not yet distributed	85,773.39
Equity Brooklyn City construction	5,018,105.10
Equity Prospect Park and Coney Island construction	108,426.96

Guarantee fund		4,005,755.00
Treasury bonds		5,513,000.00
Stock Brooklyn Rapid Transit Company		146,228.00
Accounts receivable		311,903.62
Prepaid insurance		34,260.51
Supplies		516,606.88
Cash on hand		1,470,287.54
Total		$103,195,320.47

LIABILITIES

Capital stock Brooklyn Rapid Transit Company		$45,000,000.00
Capital stock, constitutent companies not owned by Brooklyn Rapid Transit Company:		
Nassau Pref., outstanding	$448,000.00	
Brooklyn Union Elevated Pref., outstanding	285,646.58	
Brooklyn Union Elevated common, outstanding	807,027.87	
		1,540,674.45
Funded debt:		
Sea Beach Railway Company	$650,000.00	
Brooklyn, Queens County & Suburban Railroad	6,574,000.00	
Brooklyn Heights Railroad Company	250,000.00	
Brooklyn Rapid Transit Company	7,000,000.00	
Nassau Electric Railroad Company	15,000,040.00	
Brooklyn Union Elevated Railroad Company	23,000,000.00	
		52,474,040.00
Loans		1,000,000.00
Interest accrued		116,578.62
Taxes accrued		596,052.04
Rentals accrued		686,140.19
Audited vouchers		641,396.85
Accounts payable		110,106.30
Real estate mortgages		226,725.50
Contingent liabilities		180,181.27
Surplus		623,425.75
Total		$103,195,320.47

PERSONAL MENTION

MR. SAMUEL LITTLE has resigned as president of the West End Street Railway Company. He is to be succeeded by Mr. Joseph B. Russell.

MR. THOMAS F. CALFER, treasurer of the Laclede Car Company, of St. Louis, died suddenly of heart disease, Dec. 1. He was fifty-three years of age, and a native of Waterford, Ireland. He was instrumental in organizing the Laclede Car Company, and has been its treasurer since its organization, ten years ago.

MR. GEORGE W. EDWARDS, general superintendent of the elevated division of the Brooklyn Rapid Transit Company, has resigned. Mr. Edwards has been connected with the elevated systems of Brooklyn since their beginning. For a long time he was assistant superintendent under General Manager Barton, of the Brooklyn Elevated Railroad. When the latter road was absorbed by the Brooklyn Rapid Transit Company, Mr. Edwards was made general superintendent of the entire system.

ENGINEERING SOCIETIES

ST. LOUIS RAILWAY CLUB.—A regular meeting of this club will be held in the Southern Hotel parlors Friday, Dec. 14. Mr. Morris Wuerpel, Jr., signal engineer, Terminal Railroad Association, will present a paper describing the method of signaling trains through the St. Louis tunnel, illustrating the same with a stereopticon.

ENGINEERS' CLUB OF PHILADELPHIA.—In place of the stated meeting of the club, on Dec. 15, the anniversary of the founding of the club will be celebrated. President Edgar Marburg, of the club, will make an historical address entitled, "A Brief History of the Club." Carl Hering will present an illustrated paper entitled, "Popular Features of the Paris Exposition."

NEWS NOTES

LOS ANGELES, CAL.—The Mount Lowe Railway Company has perfected its reorganization. New officers and directors have been elected, and a new bond issue will be authorized.

SAN FRANCISCO, CAL.—Despite the fact that all previous attempts to secure a reduction in the rate of fare on street cars here have proved futile, it is proposed to introduce an ordinance in Council requiring that school children be transported at reduced rates.

MERIDEN, CONN.—The Meriden, Southington & Compounce Tramway Company will shortly apply for franchises in Southington, Walcott and Waterbury. The franchises are desired so as to permit the extension of the company's lines from Milldale to Waterbury.

MERIDEN, CONN.—Application will be made to the Legislature in January for the incorporation of a company to construct an electric railway from Meriden to Waterbury, extending through Cheshire. Among those interested in the new project are: Francis Atwater and Colonel C. L. Upham, of Meriden; James R. Lanyon, George W. Keeler and Walter Scott, of Cheshire; F. B. Rice and Thomas D. Barlow, of Waterbury.

NAUGATUCK, CONN.—Application is to be made at the coming session of the Legislature for permission to construct an electric railway from Naugatuck to Seymour, a distance of 7 miles. The route of the new line is from the terminus of the Connecticut Lighting & Power Company's tracks at Naugatuck, in a southerly direction, partly on the highway and partly through private rights of way, to Beacon Falls, and from thence on to Seymour.

NEW HAVEN, CONN.—The Winchester Avenue Railroad Company has begun the work of improving its Savine Rock & Woodmont Road. The line will be practically rebuilt. The tracks are to be relocated in three places and the grade of the old roadbed is to be cut down and several sharp corners eliminated in several other places. A number of new sidings will be put in, and it is thought that it will be necessary to eventually double track the entire road.

WILMINGTON, DEL.—When the Wilmington City Railway Company, People's Railway Company, Wilmington & Chester Electric Railway and the Wilmington & New Castle Electric Railway Company complete their new construction work here, the city will have the greatest street railway mileage of any city in the United States of its population.

NEW CASTLE, DEL.—The officers of the Wilmington & New Castle Electric Railway Company are considering the advisability of extending the line from Delaware City to Middletown. It is probable that the subject of extending the road will be discussed at the next meeting of the directors. Should it be extended the line would be constructed from Delaware City to Port Penn, thence to Kirkwood, St. Georges, Odessa, McDonough to Middletown. The officers of the company recently made an extended inspection of the new territory through which it is proposed to extend the road.

BRUNSWICK, N. J.—Michael Brown, of Barnwell, S. C.; F. D. McEwen, of New York; T. W. Passailaigue, of Charleston, S. C., are interested in the company which recently received a franchise here. The franchise is granted for a period of fifty years. It is required that work be begun by April 1, 1901, and that cars be in operation by Jan. 1, 1902.

BOISE, IDAHO.—The Boise & Payette River Electric Power Company has been incorporated, with a capital stock of $1,000,000, to construct an electric railway and do general electric lighting and power business. Nelson & Bramhall, of St. Paul, Minn., are the attorneys for the company.

CHICAGO, ILL.—Two attempts were made to hold up street cars on the West Side on Dec. 6. The first hold-up resulted in the capture of two of the robbers by the crew and passengers of the car. The robbers did not succeed in securing any plunder in the second hold-up, and made good their escape.

CHICAGO, ILL.—The Chicago & Grand Avenue Street Railway Company proposes to build an electric railway from Harlem and Chicago Avenues north to Grand Boulevard, and thence west to Elmwood and Franklin Park. C. C. Harris, of Montclare, is the president of the company.

CHICAGO, ILL.—The City Council has passed an ordinance providing for the equipment of all street cars with lever brakes capable of being operated from the motor cars. It is effective in the case of trailers which have been connected with the other cars simply by the coupling, and which, it was claimed, have been responsible for the inability of motormen to bring their cars to a sudden stop when necessary.

MICHIGAN CITY, IND.—The City Council has just passed an ordinance granting the Laporte & Michigan City Railway Company a franchise here. The grant is for a period of fifty years, and the company has ten days in which to file its acceptance of the grant. The franchise stipulates that the road must be completed and in operation by July 1, 1901, and, as a guaranty of good faith, the company is required to make a cash deposit of $500 with the City Treasurer, to be forfeited if the road is not finished in the stipulated time.

LEBANON, IND.—The Lebanon & Indianapolis Traction Company, which was recently granted a fifty-year franchise by the Marion County Commissioners for the construction of an electric railway on the Lafayette Pike, has filed a petition with the Boone County Commissioners, asking for a fifty-year franchise on the Lafayette Pike in this county, and also for a franchise on the Lebanon and Frankfort Pike. W. J. Devol, president of the First National Bank, is interested in the new company.

WABASH, IND.—Townsend, Reed & Company, of Sharon, Pa., are said to have secured control of the tow-path along the abandoned Erie Canal in

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

All matter intended for publication must be received at our office not later than Wednesday morning of each week, in order to secure insertion in the current issue.

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Clubrooms for Chicago Employees

The Chicago Union Traction has begun the work of reconstructing and fitting up its old Lincoln Avenue car house as a clubhouse for its employees. The building is being refitted at a cost of $10,000, and the work is expected to be completed in about three months. The building is 63 ft. x 125 ft. The basement will be fitted up with heaters, etc. An instruction room, fitted with model cars and appliances, will be provided on the first floor, and at the rear of this room will be an auditorium. This will be equipped as a theater, and will be 60 ft. x 70 ft., with a stage 28 ft. wide and 28 ft. deep. A gallery 14 ft. wide will extend around three sides of the room. Two sides of the stage will be smoking and reading rooms, while above these will be the dressing-rooms. On the third floor and to the rear of the gallery will be a dining-room, 50 ft. x 55 ft. Various smaller rooms will also be provided, and every foot of available space in the large building will be put to a use.

Extensions and New Roads in Connecticut

The near approach of the session of the Connecticut Legislature is bringing forth public announcements of the extensions of many of the established street railway lines in the State, and of many projected lines, the plans for which have been secretly worked out during the past few months. The number of extensions proposed and the new lines projected indicate a material increase in mileage, and, if they are all realized, the State will be practically gridironed with electric railway lines. Eleven years ago there were fifteen horse railways in Connecticut, and their total mileage was but little over 100 miles. To-day there are thirty-three separate corporations of the kind in the State, and these have absorbed in ten years some fifty smaller enterprises. There are in the State at the present time 492 miles of road, and the total capital stock of the companies is $12,715,948. Probably the most important new line projected is one to extend along the east side of the Connecticut River, affording a through route from Hartford to Springfield. Among the many other lines projected are two to extend between Meriden and Waterbury.

Decision Against Massachusetts Half-Fare Act

The United States Circuit Court has just handed down a decision in which it says that street railway companies are not compelled to transport school children at half fare, in compliance with the law passed by the last Legislature. The Boston Elevated was the only company exempted from the provision of the law. The decision was rendered in the case of Morris Ahern vs. the Newton & Boston Street Railway, and, although the court does not decide that the statute is unconstitutional, it plainly intimates that its opinion is that it is invalid. The case was brought by the plaintiff, a foreign stockholder, to restrain the company from complying with the statute on the ground that his rights as a stockholder would be infringed upon. The court says: "Upon its face, the statute seems to be open to the objection of unreasonably reducing the rates charged by railway companies, and to the further objection of discriminating in favor of a particular class in the community. An act, open to either of these objections has been held by the Supreme Court of the United States to be in violation of the fourteenth amendment to the Constitution of the United States. Notwithstanding I have grave doubts of the constitutionality of the act, I think, as an important constitutional question is raised, and as the plaintiff has not clearly brought himself within the rules respecting the granting of preliminary injunctions, the case should stand over for full argument upon final hearing."

Electrical Industries in Bangkok

United States Consul-General King, writing from Bangkok, under date of Oct. 15, 1900, to the State Department in regard to electrical industries in Bangkok, points out the rapid development of the electrical industries in the city, and calls the attention of American manufacturers to the opportunities for increasing trade there. There are only two companies of importance engaged in the electric line at Bangkok at present. They are the Bangkok Tramways Company and the Siam Electricity Company. There are, however, several minor concerns, and isolated plants are to be found in the city. It is estimated that there are thirteen of these plants. The Bangkok Tramway Company now operates about 6 miles of line by electricity, and has just secured franchise grants for the construction of about 5 additional miles of road through a most prom

ising section of the city. The company's lines were originally operated by horses. They were placed in operation in 1889 and equipped with electricity in 1892. The Bangkok Tramway Company and the Siam Electricity Company are about to be consolidated under the title of the latter, and it is announced that, as soon as the consolidation is completed, the company will extend the scope of its business. At present the Siam Electricity Company furnishes power only during the night, but it hereafter intends to supply power at all times and for all purposes. The company also contemplates introducing the automobile. The lighting plant was first placed in operation in 1894, and has been owned by several companies. In January, 1899, it passed into the hands of the present owners, the Siam Electricity Company. Orders have already been placed for the material to be used in extending the tramway lines, and it is expected that the new extension will be in operation by the end of next year.

The Chicago Traction Bills

The Chicago Street Railway Commission has completed its labors, and it will make the following recommendations to the Council at an early date, in reference to the transit situation in Chicago:

"Recommends short-term grants at the expiration of franchises in 1903.

"Recommends the unification of street railway systems.

"Recommends the creation of a commission on local transportation for jurisdiction over traction affairs.

"Recommends the referendum of all traction ordinances to the people on petition of 10 per cent of the voters.

"Recommends action to secure authority from the Legislature for municipal operation or ownership of street railways with the consent of four-sevenths of the voters.

"Recommends regulations to prevent over-capitalization, and to enforce annual publication of accounts."

The Street Railway Commission was created by resolution adopted in Council on Dec. 18, 1899, and its purpose was to outline a street railway policy for the city for submission to the Council, in anticipation of the expiration of the franchise of the main street railway lines in 1903. It consisted of seven Aldermen appointed by the Mayor, and $4,000 was appropriated in March last for expenses and the payment of the secretary's salary. The latter devoted his entire time to the work of the commission. The work of the commission has been chronicled, from time to time, in the Street Railway Journal. An act of the commission, which attracted considerable attention, was the submission to the people of a list of questions, on which it asked the public to express their opinion.

Suburban Company to Enter Boston Over Lines of Elevated Company

The Boston Elevated Railway Company has granted the Boston & Worcester Street Railway Company permission to operate over the Boston Elevated tracks between Newton and Boston, by way of Brookline, thus completing the trunk line which has for some time been contemplated between Boston and Worcester. The agreement is the culmination of a long wrangle between these two companies for the right of way over Boylston Street in Brookline. When the Boston & Worcester Street Railway Company announced its intention of establishing a trunk line between Worcester and Boston, it encountered but little opposition in securing franchises along the route until it reached Brookline. There the Boston & Worcester and the Boston Elevated made application for a franchise at about the same time, and, after a stubborn fight in Council, the Boston Elevated was successful. Shortly following this defeat, the Boston & Worcester introduced a bill in the Legislature providing for the operation of the cars of one line over those of another, but this bill was defeated, although it was indorsed by the Massachusetts Street Railway Association. The company was determined, however, to secure entrance to Boston, and had prepared another bill with provisions similar to the first for presentation to the Legislature. Now that an agreement has been reached, the new measure will probably not be presented. The Boston & Worcester Street Railway Company has received franchises in all the towns between the Brookline-Newton line and Worcester. All material for constructing the line has been ordered, and the work of construction will be commenced as soon as the frost is out of the ground. The route from Brookline to Worcester is over the old turnpike, and is a direct line. About 30 miles of track will be laid.

Trying to Explain the Cause of Street Car Sickness

The Union Traction Company, of Philadelphia, recently placed a number of cross-seat cars in operation on its lines, and the public expressed general satisfaction at the innovation. All progressed serenely for a few days. The public was delighted, and the company was about to congratulate itself in that it had endeared itself in the hearts of the people, when suddenly one man discovered, or imagined, he had been made sick by looking out of the window of one of the cross-seat cars. He immediately wrote a letter to the *North American*, describing the symptoms of the new disease which had attacked him, and roundly scored the company. Imagine the effect! More than one-half of the riding public at once succumbed to the new malady, and the *Philadelphia American*, which was by this time making an extended investigation as to the cause of the new illness, received numberless letters on the subject. Various reasons were given as to the cause of the new sickness; the vibration of the automatic air pump and the smell of the varnish were alleged to have caused it. The *North American*, in its efforts to explain the cause of the new illness, says: "In the new cars, with the seats running horizontally, the only place for the passenger to look is out of the window. He picks out an object in advance of the car, follows it with his eye until the optic is almost at right angles with his nose, and then glances hurriedly back again for something new to look at. If the ocular nerve be weak, this exercise will cause intense weariness, which may be accompanied by headache or nausea. In the cars with seats running lengthwise the tendency to look out of the window is not so great, and the eyes are exercised within an easier range." President Parsons, of the Union Traction Company, was convulsed with laughter when interviewed on the subject. This is what he said: "This is the most absurd and ridiculous complaint that has yet come to my attention. It is proof positive of universal insanity. The idea of a man or a woman getting sick because he or she is riding with his or her face frontward instead of sidewise! That is against all the rules of nature. I don't see why one should be more likely to look out of the windows of the new cars than the old ones. Certainly when one is directly facing a long row of windows there is nothing to prevent his looking out. As to the vibration of the air-brake mechanism, that is the funniest claim of all. If the passenger is going to be sick on account of vibration, why shouldn't the vibration of the motor cause nausea?"

The Operation of Compressed Air Cars in New York City

The Metropolitan Street Railway Company took formal control of the cars, charging station, etc., of the Twenty-Eigthth Street and Twenty-Ninth Street line on Dec. 6. The Hardie system has been used on this line since Sept. 26, and the compressed air company which controls this system has been operating the cars. A great amount of data regarding the running expenses, speed, capacity of the reservoirs, etc., have been collected during the three months that the cars have been running, which has been carefully compiled, and much interesting information obtained. From Sept. 26 to Dec. 16 the cars traveled 139,057 miles and carried 1,496,287 passengers, the maximum number of cars operated at any one time being twenty. Careful records were kept of each of the 25,283 trips, and from them the following estimations were made: Repairs, including material, supervision, machinists and workmen, adjusting valves, piping, repairing brakes, rods, brasses, etc., $35 per day, or 2 cents per car mile. Charging expenses, including oil, waste, foremen, charging gang (two shifts), oilers, cleaners, etc., $28 per day, or 1.60 cents per car mile. Power house expenses, including engineers, coal passers, firemen, oilers, pipe fitter, machinist, etc., 16 tons coal per day, oil, waste, etc., $82.50 per day, or 4.71 cents per car mile. These figures are made on a basis of 1750 miles per day, with the present equipment of twenty cars. With the same charging and power plant, however, and but little increase in cost of coal and labor, from sixty cars to eighty cars could be operated. The length of the round trip is 5½ miles, and two trips can be made on one charge. In fact, 15 miles has been covered without recharging, but this is rather too much for ordinary practice with the reservoir capacity installed.

The immense cost of conduit construction on the crosstown lines in New York renders some self-contained method of propulsion a necessity. From the above figures it would appear that the Hardie system may prove a satisfactory solution to the problem.

Electric Tramways in Barcelona and Vicinity

United State Consul-General Lay, writing from Barcelona, Spain, under date of Nov. 16, 1900, regarding the electric tramways in Barcelona and vicinity, says:

"I beg to transmit the following particulars regarding the progress made toward completing roads already in course of construction, and what has been accomplished in organizing companies and obtaining concessions and franchises for projected roads, as well as those to be changed from horse and steam to electric traction. In as many cases as I have been able to obtain them, the names of the chief contractors or persons who are likely to have charge of the purchase of construction material and equipment are given.

"1. Compañia Anonima; owned entirely in England; completed and running through the principal streets of Barcelona with a double track of about 25 miles. The chief contractors were Dick, Kerr & Company, of England. The trolley wire, trucks, electrical machinery, engines and motors all came from the United States.

"2. Ensanche line (not named). This line now runs horse cars, and is owned by another English company, although the directors are those of the Compañia Anonima, in conjunction with which it will be operated and connected. The plans and specifications are now being prepared to change the present system of horse traction to electric, and probably the same firm—Dick, Kerr & Company—will be its chief contractors. This road will be about 4 miles in length, and, although single track, the wirework necessary will be as much as if for a double track.

"3. Barcelona-Horta Extensiones; will run from outskirts of Barcelona to the town of Horta, 8 miles distant; a single track line. This road is about half completed. The contracts are all let.

"4. Barcelona and San Andres. This line, at present steam, is to be changed to electric very soon, as permission for the change has been granted by the Spanish authorities. The same company as the Barcelona-Horta line owns this one, with 5½ miles of double track. No contracts for building this line have yet been let, but information regarding them may be obtained from the Société Anonyme d'Enterprise de Travaux, Liege, Belgium. This company will also build an electric tramway from San Andres to Horta, a distance of 2½ miles.

"5. Barcelona to Badalona via St. Martin; now steam; 10 miles; G. H. Gillis, manager. Nothing has been done toward any change, but the power house now under construction for the Barcelona-Horta Extensiones is being built to furnish power to the three last named lines.

"6. Compañia General de Tranvias. The present German company has purchased franchises and concessions of the former owners, and the change from steam to electricity should soon be made, as the permanent way has been relaid for 5½ miles. Contracts for cars and equipment have not as yet been let. Details of same may be obtained from Mr. Fengercroff, representing the technical interests of the German stockholders here.

"7. Barcelona to Sans; a mule line of 8 miles, running from the center of the city. This line has lately been purchased by German capitalists intending to introduce electric traction, but they are having some difficulty in obtaining a franchise, owing to the narrowness of streets through which they wish to run; and the objection of property holders to span wires and of the authorities to the poles. The company will probably be compelled to put down underground conduits in the city and trolley in the suburbs. No contracts have been let for this line, nor has the chief engineer been appointed.

"The only hindrances to the sale of American electrical goods in Spain, when the prices are the same as those of similar articles from other countries, are the higher duties levied on American imports than on those from nations under the "favored-nation clause," and, of course, there is a prejudice in favor of obtaining machinery and equipment, everything else being equal, from the country of the principal shareholders. A direct line of steamers is now running monthly between New York and Barcelona."

Convention of the Engine Builders' Association of the United States

An account was given last week of the annual meeting of the Engine Builders' Association of the United States, held in New York, Dec. 4. As stated last week, three papers were read before the association; one by H. C. Eberet, of the Westinghouse Electric & Manufacturing Company, on "Inter-relations Between Engine and Generator Builders in Connection with Engine Type Units for Power Purposes"; another by E. T. Armstrong, of the Ball Engine Company, on "Economy Guarantees of High Speed Simple Engines," and a third by H. G. Reist, of the General Electric Company, on "Some of the Requisites of Modern Lighting Generator Sets." These papers are given in abstract below:

SOME OF THE REQUISITES OF MODERN LIGHTING GENERATOR SETS

BY H. G. REIST, OF THE GENERAL ELECTRIC COMPANY

At the Washington meeting of the American Society of Mechanical Engineers, May, 1899, an interesting and stirring paper was read by Mr. Stanwood on "Standards for Direct Connected Generator Sets." So far as I know, this was the first time that the desirability of engine and dynamo builders getting together and trying to make their designs interchangeable as far as practicable, was brought before the public. Its importance was at once realized, and action taken toward improving matters by the appointment of a committee, and by inviting other organizations interested to co-operate. I understand these committees are taking up the standardization of speeds of engines as well as the proportions of certain parts that affect the two pieces of machinery, such as the dimensions of base and the diameters of the engine shafts.

It will not be possible to fix absolute speeds for engines used for directly driving alternating-current machines, because currents of various frequencies are used for different classes of work, and dynamos must be built with an even number of poles, or, better yet, with a number of poles that is divisible by four. The ordinary frequencies used are 25 cycles, 40 cycles and 60 cycles per second in this country, but in Europe the usual frequency is 50 cycles. To illustrate the variation in speed necessary for the various frequencies: For 60 cycles and 40 cycles, a speed of 200 r. p. m. may be used, but for 25 cycles the speed should be 187 r. p. m. or 214 r. p. m. Similarly, we can make 60-cycle and 40-cycle dynamos to operate at 100 r. p. m., but the 25-cycle machines must be driven at 94 r. p. m. or at 107 r. p. m. In working over a list of speeds for the various frequencies it will be found that a mean speed may be selected which in no case need be much departed from, so that it seems perfectly practicable to select a range of speeds for the various sizes of engines at which they may be run without any changes except an adjustment of the governor. Then by a careful selection of sizes, best ranged in geometric progession, it will be feasible to keep down the number of machines very greatly, leading to duplication, thus to the practicability of making special tools for more of the parts, and also to carrying parts in stock and helping toward quick deliveries.

We have given considerable thought to the selection of a range of sizes, and have come to the conclusion that if the units were so spaced that each one has a 50 per cent increase over the one below it, there will be a sufficiently large number of machines to meet all ordinary conditions. This conclusion was also sustained by having had practical application in lines of generators and motors spaced about in this way, so that it is rarely that it becomes necessary to go to the expense of developing anything between. This method of determining sizes necessarily gives some of the machines on the list odd ratings, but this will occur in any case many times with either the engine or the generator, since one is rated in horse-power and the other in kilowatts. A table was submitted giving sizes of generators and speeds that are proposed.

The variation in speed given in the tables allows the same engine to drive generators for the three frequencies standard in this country. It will be noted that with very few exceptions the total variation in speed is less than 10 per cent—in most cases being not more than 2½ per cent from the mean speed. For each capacity given, except the smaller ones, several speeds are proposed to accommodate the different types of engine.

In all reciprocating engines there is an intermittent speed, the speed gradually increasing during the stroke until such time that the power applied is less than the mean power absorbed, after which the speed gradually decreases until steam is again admitted.

It will thus be seen that in every single crank engine there is, during each stroke or each half revolution, a period of increasing speed and one of decreasing. With two cranks at 90 degs. there will be four such periods during each half turn. With cranks set 120 degs. apart there will, of course, be six such periods. The amount of fluctuation in speed is dependent on the number of cranks, the weight of the reciprocating parts, the length of the connecting rod, the proportion and adjustment of the valves and the weight of the fly-wheels. It is desirable to keep this variation within certain limits, on account of the parallel operation of the generators, but more particularly to insure the satisfactory operation of synchronous apparatus, such as synchronous motors and rotary converters from such circuits.

When two generators are running in multiple, their mean speed will be the same, but as the speed is variable, as already explained, there is an instant during which one generator runs a little faster

than the other. It will be seen that its potential wave will then get ahead of the wave produced by the other machine, and, in consequence, current will flow into the second machine and tend to drive it as a motor. A little later, when the engines are further along in the revolution, these conditions will be reversed. This produces cross currents between the machines, which should be avoided. It might be prevented with duplicate sets, if the engines were synchronized, that is, if they were run with the cranks of the machines in the same relative position. The angle of velocity of one engine is then the same as that of the other at all times. But this is not a practical method of operation. This fluctuation is also liable to make synchronously-driven electrical machinery drop out of step. In practice, the allowable variation is usually given in displacement in degrees of any point on the roating mass from what it would have if the motion was perfectly uniform, which gives a value that is independent of the number of cranks of the engine. Steam engines intended for direct-connected dynamos should not have an angular deviation in degrees of more than 2½ degs. or 3 degs. of phase; or, dividing the number of one-half of the number of poles of the generator to be driven, will give the allowable angular deviation in terms of degrees of the rotating mass. Thus, a 40-cycle machine should be driven by an engine whose motion is so uniform that a point on the rotating mass will not vary more than $\frac{2.5}{20}$ or one-eighth of one degree from the position it would have if the motion were perfectly uniform.

In order to obtain this result it is necessary to so proportion the fly-wheel, the weight of which depends upon many things, relative to the proportion of the engine, and cannot be given except in special cases. It is specially desirable in designing the engine to proportion the fly-wheel with this object in view. The proportion of the connecting-rod is also a matter of importance in this connection. Mr. Reist here submitted data covering the fly-wheel effect necessary to meet the above degree of regulation, and submitted a formula representing a safe figure for well proportioned engines. Mr. Reist's formula covered 25-cycle, 40-cycle and 60-cycle machines, and was varied to apply to horizontal engines as well as vertical, to single cylinder engines as well as compound. It would naturally be expected that a three-crank engine, with cranks placed 120 degs. apart, would require a lighter fly-wheel than one with two 90-deg. cranks, but in working out the forces of compound three-cylinder engines, it is found that other conditions so far enter into the problem that no appreciably better result is obtained than from a two-crank cross-compound engine.

Ever since alternating-current machines have been built parallel operation has been discussed and tried, at first with great caution, but it is at present the usual method of operation of installations, and experience has taught us that any two alternators of the same frequency and potentials will operate in multiple satisfactorily, if they are allowed to do so by the prime motors. No trouble is experienced in operating machines in multiple when driven by water-wheels. There are also many installations of steam-driven alternators, ofttimes of different types, both belted and direct connected, operating satisfactorily in multiple. The principal trouble experienced in the parallel operation of alternators is due to the variation of the speeds of the machines with reference to each other, producing oscillations in the relative motions of the two alternators. This produces cross currents in the variations of the cut-offs of the engines.

In some cases the amplitude of these oscillations is limited in extent, while in others the force is liable to accelerate with more or less rapidity, until the machines drop out of step. In some cases the machines may run in parallel for a considerable period, then, by some change of conditions, oscillations will begin, throwing the machines out of step in a few seconds. The power to produce these oscillations comes naturally from the steam, and is caused by the intermittent action of the engine governors, which, in their efforts to adjust themselves to compensate for the speed variation, cause a periodic delivery of steam. This delivery of steam by jerks keeps up the oscillation in the same manner as the pendulum of a clock. The frequency of this variation is affected by many conditions aside from the fly-wheel effect of the rotating mass on the engines; e. g., the period of the engine impulses the synchronizing power of the dynamo, and probably the fly-wheel effect of any synchronous machinery driven by the current from the dynamo.

The degree of retardation of the governor required by proper parallel operation must depend upon the combination of these effects, and is consequently difficult to pre-determine. Mr. Reist submitted one or two illustrations covering this point and the manner in which the difficulty had been satisfactorily overcome.

There are, however, cases where a simple retarding device is not sufficient without seriously affecting the governing of the engine. A special device was suggested to cover a case of this kind. Engines that are directly coupled to alternators that are to be run in parallel should be provided with means by which the speed may be adjusted within a small range without throttling while the engine is running. Such a device is very useful in bringing the machines together without throwing them into parallel when one machine is loaded and the other is idle, otherwise it is necessary to throttle the steam for the engine without load to bring it to the speed of the loaded machine. This device is also very useful to divide the load between the machines, since, however carefully adjusted, high temperatures or some other local condition may throw them slightly out of adjustment.

ECONOMY GUARANTEES OF HIGH-SPEED SIMPLE ENGINES

BY E. J. ARMSTRONG, OF THE BALL ENGINE COMPANY

I have been asked to read a paper upon the general subject of the economy of simple high-speed engines. I esteem this a rare privilege, and the more so because of my belief that the single-valve automatic is not always given a fair chance.

The matter of economy does not always receive consideration. The engine that runs smoothly, noiselessly and punctually will have friends and purchasers whether it uses much or little steam. I have no desire to advocate improvement in economy to the detriment or neglect of other qualities which go to make up successful machines, but I believe that many engine builders have but a very imperfect idea of what their own engines were capable of. If the subject were more amenable to mathematical treatment the case would be different, but in spite of the marvelous advancement in science at the end of the century, I believe that the exact formula for the economical performance of the steam engine has yet to be written. In view of the fact that the steam used by an engine often costs each year as much as the engine itself, it would seem as if the customer might consider steam economy as of first importance and price as a bad second. Yet even a small difference in price or a personal preference will decide a purchase without raising the question of economy at all. A difference of 10 per cent in steam consumption between two engines might easily place the more wasteful one in the position of being too expensive, even as a gift; but there is no doubt that there have been, and still are, even greater differences than this between engines that are sold on equal terms. It is singular that customers who figure so closely on other matters should be so careless and unbusinesslike in this, or that builders should expect to market engines with no economical record, and not even a pedigree. This rather anomalous condition of things will soon be brought to an end; for years there has been an increasing tendency among customers to raise the question of steam consumption, and builders of engines must recognize this and prepare to meet a demand for definite promise and performance in the matter of economy.

This should be welcomed, not as a hardship, but rather as an opportunity. It is essential to obtain more exact data concerning the performance of automatic engines, and in making an effort to improve the quality of work turned out the first step is a systematic effort of finding the defects in that work. The first move in reducing cost is to find out what things are costing, and the way to improve the economy of engines is to test them systematically and to learn their deficiencies.

It is not usually practical to test engines of small size after installations; the expense is disproportionate, and the difficulties in the way of obtaining accurate results are great. The liability to error and the impossibility of running preliminary tests make it unsafe to make close guarantees to be demonstrated in this way. The proper place to test an engine is on the shop testing floor. With properly arranged apparatus tests can be made in a short time, and at little cost.

Apparently a simple thing to make duty tests with apparatus of this kind, the matter is really more complicated than it seems. A detailed description of precautions necessary and the methods of detecting and locating errors, or the causes of irregular and inconsistent results. This method of testing engines cannot fail to impress one with the great difference in accuracy possible when compared with the plan of testing after installation, as must be done with very large engines under any circumstances.

The manner in which different tests check up with each other is to some extent proof of their accuracy, and gives confidence in using the data obtained as a basis for future guarantees. I have here several duty curves, plotted from tests made in the ordinary course of demonstrating economy guarantees. The majority of the series of tests shown in these diagrams have been checked by engineers representing the purchasers. In other cases reliance had been placed on the builder to see that his guarantees were fulfilled. The rate of water consumption was plotted without correction for dry steam, for which, however, a proper allowance was made. These results were not at all exceptional, as is proven by

the fact that they practically duplicate each other. They show what can be readily obtainable in regular practice, with fairly tight valves, moderate clearance and other conditions as he described. There are other details which contributed to the result. These have to be learned by practice, and can be learned at all only by frequent tests.

The single-valve engine is capable of giving results even better than those shown on the diagrams, to the extent of 1 lb., or perhaps 1½ lbs., per hour. At the same time the results are very much better than the average of high-speed work. These tests show that it is possible to approximate very closely the difference in economy which may be expected from a change in steam pressure, from a change in back pressure, from an increase or reduction in speed, etc. It was possible also to speak with considerable accuracy of the difference in economy between a large engine and a small engine of the same general design or of the difference in the same engine when carrying a greater or smaller percentage of its load.

In estimating the steam consumption of an engine of a size or under conditions which have not yet been tested, there are two ways of figuring; one is to determine the losses in the engines separately from the steam accounted for by the card. This method, while quite complicated, is the more accurate of the two, and is sometimes very valuable in working out a close guaranty. The other plan is simply to learn the general effect of the different conditions which affect economy, and to use some previous tests as a basis.

The building up of a better reputation for automatic engines is well worth the attention of its manufacturer. No guarantee of economy should be given unless its fulfilment by actual trial is provided for. Where there is no certainty that a test will be made, there is the temptation to give a lower water rate than would be the case were its fulfilment one of the conditions, especially if accompanied by penalties for failure to meet the terms of contract.

This question of penalties is considered quite onerous by engine builders, but if not provided in the contract, the only penalty is the non-acceptance of the engine; and as this is often impracticable, because of lack of time, there is a good chance that the guarantee is not worth anything. Definite penalties at least have the effect of protecting those who really make their guarantees in good faith and with a knowledge of what they can do. There is nothing wrong about it from the purchaser's standpoint. A deficiency in economical performance means a direct and continuous loss to him. There is one feature of the situation that is manifestly unfair, and calls for remedial action. Better economy costs money. It may not actually cost more to build the high duty engine than a wasteful one, but it costs a good deal more to learn how, and to keep up the standard afterward. It costs money to tune an engine up to meet a close guarantee, and testing engines is an expensive business at the best. There should certainly be an addition to the price when guarantees are required. All duty guarantees should provide for their fulfilment on the shop floor test before shipment, and should always be considered as an extra, it being optional in all cases with the purchaser to accept the proposal with or without the guarantee. If the guarantee does not mean anything, it should not be made. If it does stand for something, it costs a good deal, and is worth to the customer all that he is likely to be asked for it.

INTER-RELATIONS BETWEEN ENGINE AND GENERATOR BUILDERS IN CONNECTION WITH ENGINE TYPE UNITS FOR POWER PURPOSES

BY H. C. EBERT, OF PITTSBURGH

I have thought this occasion particularly favorable to discuss the relations between the engine and generator manufacturers for the purpose of promoting co-operation and harmony, and to prevent causes for disagreement

Purchasers continue to express a strong preference for direct-connected apparatus, and there is now an extremely large demand for this. It is proposed, therefore, in this paper, to deal specifically with the subject of so-called engine-type electric generating sets. The manifold advantages of the engine-type direct-connected generator unit for power, traction and lighting purposes over the old style high-speed belted type are so apparent to all of us that I think they need not receive consideration here. The management of the Westinghouse Electric & Manufacturing Company is glad of the opportunity to place before your association some of the points which, in its opinion, might advantageously be considered jointly by the engine and the generator builders, with the object of establishing, if possible, a uniform practice in treating these same complex conditions which arise in getting the two parts of an engine type unit successfully installed. We have observed that when the consulting mechanical or electrical engineer specifies the size and type of the generator unit to be furnished, he generally designates an engine that in capacity, speed and regulation will closely correspond with the same characteristics of the generator to be provided; but when the selection of an engine to drive a certain size generator is made by the purchaser, or he is coached in his selection by the ordinary generator or engine salesman (and this is oftener the case than one would generally suppose), an engine is invariably secured, which in these three most important features does not match the electrical part of the outfit. It is in these latter cases where eventually the engine builders have their difficulties and we also have ours, for the engine and generator are correctly considered by the purchaser as a single unit, and the failure of one part to meet his requirements constitutes, from the purchaser's standpoint and that of his engineer, sufficient grounds to withhold his acceptance and purchase of any part of the unit. Manifestly, this is a hardship to the manufacturer whose apparatus is, in all respects, what it should be and as represented. Our object and yours should be to minimize the chances of an improper combination of engine and generator, and to this end we will invite correspondence from the engine builders and give close attention in the appropriate departments of our works to any inquiries they may make respecting the electrical or mechanical details of the generator set to be provided, so that perfect calculations may be made for efficiently driving the generator from which ultimate power is to be derived.

The engine and generator specifications must be analogous, in so far as capacity, speed and regulation are concerned. It is the general practice of the dynamo builders to give their machines a normal rating, allowing for 25 per cent, 50 per cent or 75 per cent overload for certain periods, ranging from 10 minutes to 2 hours, and sometimes longer. This overload capacity, upon which the electric companies' salesmen lay considerable stress, avails the purchaser nothing if the steam end of the unit is inadequate to care for it. Will not your interests, the purchasers' and ours be better conserved if we get together on these features to start off with?

There should be uniformity in rating engines with regard to overload capacity of the generator to be driven. Of course, steam pressures, belting, etc., operate to change the engine capacity, but it would seem there could be greater uniformity than has yet been shown.

The engines for direct or continuous current power work should be designed to regulate quickly for sudden changes in the load, and the drop in speed from no load to the maximum load, however, should be as nearly a straight line as possible.

This is absolutely necessary to properly care for the over-compounding of the generator as the load increases. It should be noted that what would be considered an ideal regulation and operation in a direct-current installation would not be satisfactory with alternating-current power generators. There is no difficulty whatever in running two or more direct-current generators together on the same circuit and dividing the loads equally and maintaining them practically constant on the different machines. However, in running alternators together, particularly at slow or medium speeds, the problem is different. In order that each alternating current machine shall deliver its proper share of current for the common circuit, the machines must work harmoniously and simultaneously. The fundamental requisite being that the e. m. f.'s or voltages produced by the two or more machines operating in parallel must be equal at all times. If not, then at any instant when the voltage of one machine is lower than that of the others, a current will be sent through it from the other machines; this, of course, not being desirable.

If the engine governors tend to give different speeds, say, 500 r. p. m. and 525 r. p. m., respectively, then it is evident that when the two alternating-current machines are in parallel, the machine which tends to run at the higher speed will carry all the load until the speed is reduced to 500 r. p. m., when the second machine will begin to carry load.

It is essential that the governing of the speeds of the alternating current machines shall be such that when running at a common speed they shall receive their proper amount of power. As stated heretofore, it is to be observed that engines which govern closely between no load and full load, may not be as well adapted for running alternating-current generators in multiple as other engines in which the regulation is not so close. For example, if one engine runs at no load at 100 r. p. m., and drops off 1 per cent at full load, and a second engine also drops 1 per cent between no load and full load, but happens to run at a slightly higher speed, say, 101 r. p. m. at no load and 100 r. p. m. at full load, then it is evident that one engine would carry its full load before the other engine had begun to carry any load. If, on the other hand, the engine

drops 5 per cent in speed; that is from 100 r. p. m. to 95 r. p. m. and from 101 r. p. m. to 96 r. p. m., respectively, then a comparatively small load will reduce the speed of the latter to 100 r. p. m., so that the engines will begin to work together almost instantly the generators are thrown in parallel, the engine which tends to run faster carrying only a slight excess load.

A member of your association suggested that this paper contain something to bring about a discussion of what the engine builders should do and what not, and the best way to avoid disputes and disagreements, presumably between the purchaser, the engine contractor and themselves. There would seem to be no good reason for dissension or disagreement if the engine company to furnish the engine and the electric company to furnish the generator will acquaint each other with the general terms of their contracts with the purchaser in so far as those terms relate to the integral parts of the generator and engine combination to be supplied. In taking up correspondence with this object in view, we will at once disclose any discrepancy in what we are to furnish conjointly to make a complete unit. Usually the parts which are not clearly covered in either the engine company or the electric company's agreement are of a minor and inexpensive character, but still, if no attention or thought is given to them, we find ourselves on the ground with a shortage that will seriously retard the erection work, and greatly increase its cost. Up to and including 125-kw engine type generator, 200 r. p. m., we furnish simply the bare machine, that is, the fields and armature, without shaft, shaft key, outboard bearings, bed-plate, steel guide strip and holding-down bolts. When we contract for the entire unit our order to the engine company clearly stipulates the parts just enumerated as not being a portion of the generator, and are to be included with the engine. With machines of larger capacity than 125 kw we supply bed-plates, steel guide strip and holding-down bolts, as usually the larger sizes can not have a common sub-base with the engine. These remarks so far, excepting where they relate to parallel running of alternating-current generators, treat specially with continuous current 125, 250 or 550-volt generators. Conditions surrounding the combined alternating-current engine type unit for power purposes are somewhat different, and will be referred to later on.

It is assumed that all the members of the Engine Builders' Association are familiar with the work that the committees on "Standards for Direct-Connected Generating Sets," appointed by the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, have thus far accomplished in the direction of standardization, and it is confidently anticipated that their final reports will lead to some definite and unanimous action along that line. The time has certainly come when such steps should be taken to prevent unreasonable requirements, and this standardizing of sizes, speeds, shaft diameters and general dimensions, if strictly adhered to, will undoubtedly be a strong preventive measure. The report of the committee already published, which was, I believe, but tentative, recommended capacities, speeds and probable shaft sizes for center and side-crank types of engines from 25-kw to 250-kw capacity generators, inclusive. It made no definite comments on the subject of armature-spider bore, press fits and the method of keying to shafts. In connection with these questions, I would like to outline here briefly Westinghouse Electric & Manufacturing Company's standard practice, with which we have invariably had success. Armature spiders are arranged to receive a shaft amply large for extreme rigidity, so as to eliminate crank action, as far as possible, it being absolutely necessary that the armature run perfectly central in the fields to prevent unbalanced magnetic pulls. Shafts are figured for both deflection and fiber stress, taking into account the possible unbalanced magnetic pull. In submitting generator drawings to engine builders, we call attention to this magnetic action if the armature becomes decentralized, and state on the drawings the amount of magnetic pull which may be expected on the generator. As this unbalanced magnetic pull acts at right angles to the shaft, and may be in any direction to the plane of revolution, it should be carefully considered, not only for the shaft diameter, but also for strength of foundation, sub-base and bearing housings. The connection between the out-board bearings and the sub-base should be perfectly rigid. One or two instances wherein this magnetic action was not taken into consideration by the engine contractor finally resulted in almost total destruction of both engines and generators.

We make allowance for press fit in the armature, the amount depending largely on the material, or rather the quality of the material in the spider. This is such that the fiber stress per square inch produced by forcing the hub on the shaft is greater than the fiber stress produced by centrifugal force due to the rotation of the armature at maximum running speed. The engine shaft and gages should be absolute, as a matter of record. It is a simple thing to use pin gages, and they are better for giving close results. We, therefore, supply exact shaft gages to the engine builder as soon as the shaft diameter is settled. Two short press fits are employed, one at each, and of the spider hub. It is our practice to use only a single feather or parallel key, half in the shaft and half in the hub. This key is furnished by the engine builder and fitted tightly to the shaft sidewise. Between the top of the key and the bottom of hub keyway, there is a clearance of about 1-32 in. The feather key admits of easily centering the armature, acts as a guide in pressing it to position, and does not deform the hub as a driving or tapering key tends to do. We supply key gages at the time shaft gages are sent to the engine maker.

The foregoing remarks relative to standardizing apply simply to direct-current generators. With respect to alternating-current engine type machines the case is not so simple. There is not the same demand for uniform standard of alternating-current dynamos, there being fewer builders of this type of apparatus. Usually, also, the generators are of such large size that it is not a requisite requirement to have everything in accordance with a predetermined standard. It would be difficult to even assign standard limiting dimensions, since there are usually two types of construction—one in which the field moves at right angles to the shaft, and the other in which it moves parallel to the shaft; this, of course, requiring different engine arrangements, especially in regard to shaft lengths. Consequently, to properly combine an engine type alternating-current unit, even of the smaller capacities, the drawings should be taken up in each case and the necessary arrangements made for a successful combination.

In general, I would add that the Westinghouse engine-type generators, for both alternating and direct-current power work, can be designed with either of the following characteristics:

1. The generator revolving element may be pressed and keyed on an extension of the engine shaft, the engine builder furnishing the shaft, shaft keys and outboard bearing.

2. The generator may be self-contained and include the shaft, shaft keys, outboard bearing and a half coupling flange for directly connecting to the engine shaft or fly-wheel.

3. The generator revolving parts may be designed with a flanged extension for directly connecting to the fly-wheel. The shaft on which this revolving element is pressed and keyed may or may not be a part of the engine shaft.

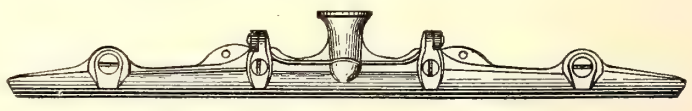
4. The large machines, 850 kw and above, can be built with bosses on the spider arms for directly connecting to an extension on the engine fly-wheel. In either of these cases the Westinghouse Company will provide the necessary gages and templates to enable the engine manufacturer to arrange his parts for connecting to the generator. Mr. Ebert added that there was much more to be said on the subject of the relations between the engine builder and the generator builder, which would be more clearly and successfully brought out by the general discussion which followed. Mr. Ebert also presented a number of drawings illustrating different types of generator construction, on both large and small machines, which were examined with interest by the engine builders present.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED DEC. 4, 1900

662,921. Apparatus for Electric Traction; H. Dolter, Paris, France. App. filed July 6, 1899. A pendulum circuit closer arranged in a box in the roadbed is lifted and swung to close the circuit by a magnet carried on the car.



PATENT NO. 663,198

663,138. Combined Rail Chair and Joint Block; G. T. Thompson and A. J. Lechler, Philadelphia, Pa. App. filed May 22, 1900. Two castings surrounding the lower portion of the rail and constructed with interlocking parts.

663,198. Clip for Trolley Wires; W. H. Russell, Watertown, Mass. App. filed March 20, 1900. The clip consists of two parts hinged together and provided with an irregular groove, in which the wire is to be seated, and held by clamping the parts together.

663,233. Connection of Strikers to Motor Vehicles for Mechanically Operating Electric Switches; W. Kingsland, London, England. App. filed July 10, 1900. The striker is mounted on the axle, so as to partake of all the movements thereof, and thus maintain a constant relation with the rail.

663,360. Electrical Rail Bond; W. Pervenko, Kiew, Russia.

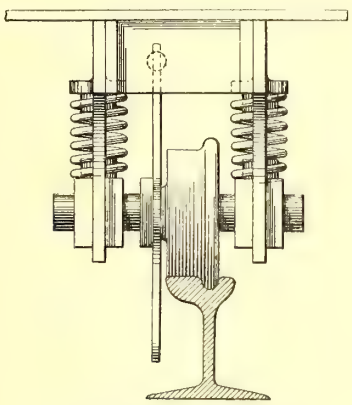
App. filed Dec. 30, 1899. The bond consists of a steel ribbon, extending continuously between the track rail and its support.

663,398. Electric Railway; E. Sussmann-Hellborn and W. Hornauer, Munich, Germany. App. filed Oct. 11, 1900. In an induction system the core of the secondary carried on the car, and that of the primary fixed in the roadbed, are laminated, and the laminations of the one extend into the spaces between the laminations of the other to afford intimate magnetic relation.

UNITED STATES PATENTS ISSUED DEC. 11, 1900

663,499. Car Moving Mechanism; M. Johnson, Milwaukee, Wis. App. filed April 23, 1900. An internal gear is cut on one of the wheels and a crankshaft is mounted in suitable bearings, supported from the axle, and carries a pinion engaging with the internal gear, by which the car can be moved by manual effort.

663,519. Electric Rail Brake; R. W. M. Schiemann, Dresden, Germany. App. filed May 22, 1899. A multipolar electro-magnet having a series of coils connected alternately to be positive and negative is arranged just above the rail, but when energized will be drawn downward against the rail surface, to afford the braking action.



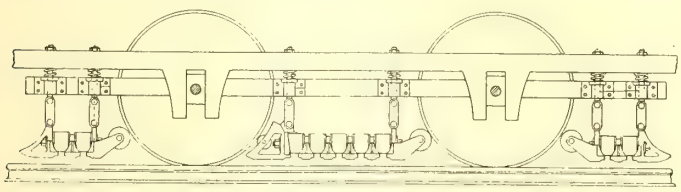
PATENT NO. 663,223

663,525. Elevated Single Rail Railway; A. A. Welsh, Allegany, Pa. App. filed Aug. 20, 1900. The invention consists in the arrangement of the guard wheels to afford equilibrium.

663,600. Electric Railway; T. P. Chandler, Philadelphia, Pa. App. filed Oct. 22, 1900. This is a temperage system, in which the invention relates to the details for supporting the conducting wire and the cable.

663,605. Wire Coupling; W. Frankham, Canton, Ohio. App. filed May 24, 1900. The sleeve into the ends of which the wires project contains an enlarged central cavity wherein the ends of the wires are looped to form enlargement preventing their withdrawal.

663,625. System for Electric Traction; M. T. De Felice, Rome, Italy. App. filed June 9, 1900. The electro-magnetic switch which closes the circuit to the working sections is provided with a number of coils, one of which closes the circuit initially, another holds it closed, and another opens the switch.



PATENT NO. 663,519

663,671. Car Brake Operating Mechanism; H. Blumenberg, Jr., New York, N. Y. App. filed July 20, 1900. The power to set the brake is obtained by bringing two cone pulleys into engagement, one of which is driven from the axle.

663,740. Trolley for Electric Cars; W. H. Earl, Painesville, Ohio. App. filed Aug. 14, 1900. The harp is pivoted to swing laterally, and a frame carrying the wheel is pivoted to swing on a vertical pivot.

663,747. Car Starter; T. Geraghty, Bayonne, N. J. App. filed Oct. 12, 1900. Consists of a bar having a wedge-shaped end, provided with roughening corrugations on the upper and lower side to grip the wheel and the track.

663,788. Trolley Pole; W. Schroeter and A. Kurtzmann, Dallas, Texas. App. filed June 11, 1900. The pole is fitted with a trolley wire finder, consisting of an arm attached to the rope in such a way that it may be thrown into position to conduct the wheel to the wire, and when that is accomplished the slackened rope permits the arm to assume a position where it will not interfere with the running of the wheel.

663,817. Aerial Wire Rope Tramway; J. H. Montgomery, Denver, Col. App. filed May 14, 1900. Means for automatically releasing the gripping lever at the loading station, whereby the carrier is allowed to stop until the bucket is filled, while the endless rope continues its movement.

663,827. Car Brake; P. Boch, New York, N. Y. App. filed March 30, 1900. Details of a brake in which two shoes are used respectively against the wheel and the rail.

PERSONAL MENTION

MR. WARREN H. HAUTSCH has resigned as superintendent of the Staten Island Midland Railroad Company, of Stapleton, S. I., N. Y.

MR. C. W. WOODWARD has been appointed purchasing agent of the Electric Storage Battery Company, of Philadelphia, to succeed the late Mr. John B. Falkner, Jr.

MR. J. S. HAMLIN has resigned as superintendent of construction of the Christensen Engineering Company, of Milwaukee, to accept the position of manager of the Auto-Appliance Company, of Chicago, manufacturers of automatic couplers.

MR. W. CARYL ELY, president of the International Traction Company, has just returned from a ten-week trip to Europe. Mr. Ely was accompanied by his wife, and they spent five weeks in France, a week in Brussels, Antwerp and adjacent places, and one week in England.

MR. JAMES SMITH, formerly superintendent of the Elizabeth division of the North Jersey Traction Company, of Newark, N. J., has just been made general manager of the Elizabeth, Plainfield & Central New Jersey Street Railway Company, which controls the line between Elizabeth and Plainfield. John Adelmann, who has been superintendent of that road and also of the Plainfield Street Railway, will hereafter be superintendent of the Plainfield line. Mr. Smith will make his headquarters in Westfield.

PROF. ALFRED E. BURTON, of the Massachusetts Institute of Technology, has been invited to accompany an expedition, which is to make a careful trial of the method of use in the field and on extended work of a new base measuring apparatus which has been perfected under his supervision by members of his classes. The apparatus has been recently tested by the Coast and Geodetic Survey in Washington, and such satisfactory results have been reported that it is about to be used in the important triangulation measurements in Texas.

MR. DUNCAN McDONALD, the retiring superintendent of the Montreal Street Railway Company, of Montreal, Que., was tendered a reception by the officers and employees of the company, and his numerous friends a few days ago. Every employee of the company who could be excused from duty attended the demonstration in honor of Mr. McDonald, and the officers of the company were present. General regret was expressed at Mr. McDonald's retirement, and a letter from the employees was read, wishing Mr. McDonald every success in his new position. Mr. McDonald was presented with a solid silver casket, suitably engraved, containing a sum in gold, as a token of appreciation, and Mrs. McDonald was presented with a silver toilet set.

MR. CHARLES S. CLARK, secretary of the Massachusetts Street Railway Association, was presented with a handsome solid silver pitcher at the meeting of the association, held Nov. 14, Mr. R. S. Brown, of the Westinghouse Electric & Manufacturing Company, made the presentation, and Mr. Clark responded with an appropriate speech. Speeches commendatory of Mr. Clark were made by Mr. John R. Graham, president of the association; Mr. C. S. Sergeant, of the Boston Elevated Railway Company; Mr. H. B. Parker, of the Newton & Boston Street Railway Company, and E. C. Foster, of the Massachusetts Companies. Mr. Clark has planned and carried out very successfully all the excursions to the street railway conventions, and the pitcher was a tribute of appreciation of his services.

MR. F. L. DAME has resigned as general superintendent of the Tacoma Railway & Power Company, of Tacoma, Wash. Mr. Dame has been connected with the Tacoma street car lines as superintendent for five years. He came to Tacoma in 1892 to take charge of the construction of the Point Defiance line, and three years later became superintendent for the Tacoma Railway & Motor Company. When consolidation of all the city lines was effected Mr. Dame was made general superintendent. He has been

on the Coast for eleven years, coming to Portland in 1889 from Boston to represent the Westinghouse Company. He spent two years in Vancouver, B. C., going there to take charge of the construction of an electrical plant. Later he went to Portland again and came from that city to Tacoma. Mr. Dame will reside at Marshfield, Mass., in the future.

MR. ASA M. MATTICE has been appointed chief engineer of the Westinghouse Electric & Manufacturing Company, and will enter upon his new duties immediately. During the past year Mr. Mattice has been engaged in remodeling the Cocheco Cotton Mills at Dover, N. H., but for the ten years previous he has been actively connected with the design of all the large machinery coming from the office of E. D. Levitt, of Cambridgeport, Mass., Mr. Mattice having been principal assistant to Mr. Levitt for the entire period. Mr. Mattice was a classmate of Mr. B. H. Warren, vice-president of the Westinghouse Electric & Manufacturing Company, having graduated as an engineer from the Naval Academy in 1874. He was assistant to Admiral Melville at the beginning of the new navy, and had an important part in the design of the machinery of the "Maine," "San Francisco" and others of the important early ships. The Westinghouse Company is to be congratulated on the additional strength which he will give to its already strong engineering staff.

ENGINEERING SOCIETIES

FRANKLIN INSTITUTE.—A stated meeting of the institute committee on science and the arts will be held Jan. 2.

NEW YORK RAILROAD CLUB.—The next meeting of the club will be held at the rooms of the American Society of Mechanical Engineers, New York City, Dec. 20. The address of the evening will be given by J. V. Davies, C. E., on "Railroad Tunnels: Their Construction, Maintenance and Operation."

ILLINOIS ELECTRIC ASSOCIATION.—The first annual meeting of the Illinois Electric Association was held at the University of Illinois, Nov. 27. The members of the association comprise the Illinois electric companies or individual owners of electric light plants doing a general commercial lighting business from a central station. There were fifty-two delegates present, and several visitors interested in the development of electrical engineering Several technical papers were read and discussed at the meeting, including the following: "Meters vs. Flat Rates," by M. C. E. Hay; "Enclosed Long Burning Arc Lamps," by W. J. Ferris; "Desirability of Moderate Sized Cities Operating Day Power Circuits," by H. J. Pepper; "Minimum Monthly Charges and Meter Rent," by S. S. Davis.

NEWS NOTES

SAN FRANCISCO, CAL.—The Market Street Railway Company has applied to the Council for a twenty-five year franchise for the construction of a single or double-track electric railway from Third Street along Townsend to Second Street, and along Second Street to Brannan.

LOS ANGELES, CAL.—A boiler exploded in the power house of the Los Angeles & Pacific Electric Railway Company at Sherman a few days ago, injuring several persons. The plant is said to have been damaged to the extent of $25,000 by the explosion.

BRIDGEPORT, CONN.—The Bridgeport Traction Company is rebonding a large portion of its tracks. It is estimated that the new work will cost $20,000.

PUTNAM, CONN.—In the report of the street railway taxation in Connecticut on page 1206 of last week's issue the People's Tramway Company is given as paying $2,840. The treasurer of the company states that this should read $4,574.

NEW HAVEN, CONN.—The Fairhaven & Westville Railroad Company will present several petitions to the General Assembly for the extension of its lines over routes parallel to the steam railways to surrounding towns, and will petition for franchises to build lines running in every direction out of New Haven and over every route that it is possible to run parallel to the steam roads. Among the surrounding towns which the company wants to reach are Milford, Derby, Wallingford and Cheshire, to all of which the steam road is the only means of rapid transit at present.

ATLANTA, GA.—An ordinance has just been introduced in Council providing that no franchise grants be made in the future without suitable compensation to the city for the grants.

ATLANTA, GA.—The Council has passed an ordinance granting the Atlanta Rapid Transit Company the right to construct lines on Randolph Street, State Street, Mangum Street, Grant Park and Cherokee Avenues, Windsor Street and Forest Avenue.

CHICAGO, ILL.—A car of the Calumet Electric Street Railway Company jumped the track a few days ago. Four persons were injured.

LEBANON, ILL.—The Lebanon Commercial Club has developed a new project for an electric railway from Lebanon to East St. Louis. A proposition has been made them by E. L. Thomas, of Belleville, under whose management the East St. Louis & O'Fallon coal road has been completed to within a mile or two of O'Fallon, 6 miles west of Lebanon. Mr. Thomas proposes that the projects be linked, and that his coal road be extended to Lebanon over the right of way already secured by the Lebanon Commercial Club. The probability is strong that this proposition will be acted upon, inasmuch as Mayor Stephens, of East St. Louis, who has been chiefly interested with the Commercial Club in the proposed electric road to Lebanon, is interested in the completion of the Thomas road.

CHICAGO, ILL.—The Chicago, Evanston & Northern Street Railway Company has made application to the Council of Evanston for a fifty-year street railway franchise. The purpose of the company is to construct an electric railway from Lake View through Evanston to Grosse Point. The company agrees to pave all of the streets used for its purposes with compressed brick and to keep them in repair at all times. The brick is to be of the best and the privilege is given the city of superintending the work. The company also offers to pay the city 2 per cent of the gross receipts after and during the second ten years that the franchise has been in operation. After and during the fourth ten years that the franchise has been granted the city is to receive 3 per cent of the gross receipts of the company, and after the fifth ten years, should the franchise be renewed, 8 per cent. The names of those interested in the company are not set forth.

INDIANAPOLIS, IND.—The Indianapolis Street Railway Company has put a number of new combination cross and side-seat cars in use. In the forward half of the car the seats are arranged crosswise, while in the other half of the car side seats are used.

INDIANAPOLIS, IND.—On Dec. 12 the County Commissioners granted the Indianapolis & Northwestern Railway Company a franchise for the construction of an electric railway over the Crawfordsville road. The franchise is granted for fifty years. The company is to pay $25 into the County Treasury the first of each year for each mile of track in the county. Construction is to begin not later than May 1, 1901, and the road is to be completed by June 30, 1902. If the company fails to comply with the contract the franchise will be forfeited.

MARTINSVILLE, IND.—The County Commissioners have decided to extend the franchise of the Indianapolis & Martinsville Traction Company to Sept. 1, 1901, provided the company files a bond of $20,000 by March 1, 1901, that it will have the road completed in due time. The former franchise would have expired Jan. 1.

GREEN CASTLE, IND.—The County Commissioners have granted W. B. Vestal and others a franchise to construct and operate electric lines on all of the principal thoroughfares in Putnam County.

INDIANAPOLIS, IND.—William C. Jamison, Charles L. Davis, James R. Riggs, A. A. Homes and W. H. Hawkins have filed a petition with the County Commissioners of Sullivan County, asking the grant of a franchise for the construction of 20 miles of electric road in Sullivan County.

TERRE HAUTE, IND.—The Board of Public Works has made known the terms on which it will give the Wabash Valley Electric Company a franchise. It provides for a deposit of $24,000 in cash by the company. Four roads are to be built. As fast as a line is completed, the company is to have $3,000 refunded, and the city is to retain $12,000 as remuneration.

INDIANAPOLIS, IND.—The Board of Public Works has signed a contract with the Greenwood and Greenfield companies by which they are to sell Indianapolis Street Railway Company's tickets at prices now charged by the latter, and are to pay an annual fee to the city for each car used on the city's streets. This contract must be ratified by the Council. The board has receded from its original position to permit the interurban companies to charge a straight 5-cent fare in order to discourage city traffic.

MIDDLESBORO, KY.—The Straight Creek Coal Company contemplates constructing an electric railway up Straight Creek for a distance of several miles. The road will extend to the new mines which the company is about to open, and will be used for transporting both passengers and freight.

BANGOR, MAINE.—The first snow storm of the season in New England started here Dec. 4 and continued through the night and the next day. No attempt was made to operate electric cars until Dec. 5.

WESTBROOK, MAINE.—The Westbrook, Windham & Naples Electric Railway Company has petitioned the Legislature for permission to extend its lines to Gorham and Cumberland Mills.

YORK, MAINE.—The York County Electric Railroad Company has been incorporated, with a capital stock of $44,000, to construct an electric railway from York to Waterboro and Limerick, a distance of 11 miles. The incorporators of the company are: William W. Mason, William R. Anthone, Charles G. Moulton and Samuel F. Clark.

NORTHBRIDGE, MASS.—The Worcester & Blackstone Valley Street Railway Company is now operating its line through to Whitinsville, making hourly trips.

PALMER, MASS.—The stockholders of the Palmer & Monson Street Railway Company held their annual meeting Dec. 10. The following directors were elected: Charles E. Fiske, Charles B. Fiske, Edward Fairbanks, W. H. Fairbanks, C. A. Granis, W. G. Bushnell, A. W. Paige, George C. Flynt, G. D. Fuller.

LINCOLN, MASS.—The Railroad Commissioners have denied the applications of the Lexington & Boston Street Railway Company and the Concord & Boston Street Railway Company for locations here.

MILLBURY, MASS.—There was a spirited hearing before the Railroad Commissioners Dec. 11 in the contest over the proposed location of the Worcester & Suburban Street Railway Company's tracks on Main Street, as ordered by the Aldermen to allow the Worcester & Blackstone Valley Street Railway to enter the city. The Railroad Commissioners will announce their decision in the matter in a few days.

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EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

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Cleveland City Stock Increase

At the January meeting of the stockholders of the Cleveland City Railway Company a proposition will be considered to increase the capital stock of the company from $8,000,000 to $9,000,000. It is probable that the present stockholders will be allowed to subscribe for the new stock at par, pro rata. The increase is to be made to pay the expenses of changing the cable lines to electricity, and providing new rolling stock and equipment.

Right of a Property Owner to Sue

Judge Bigger, of the Common Pleas Court, decided, in a recent suit in Columbus, Ohio, that if a property owner fails to consent to the granting of an electric railway franchise, he can not take advantage of the fact and bring injunction proceedings unless he is about to sustain some substantial damage. He can not assault the franchise except as a taxpayer in the interests of himself and other taxpayers. The judge held that the fact that ingress to a premises was being interfered with; that the view was obstructed by poles and wires, and that horses and domestic animals would be frightened by cars, did not constitute damage, and that the plaintiff was not entitled to damages on such grounds.

Strike at Scranton

The employees of the Scranton Railway Company, of Scranton, Pa., went on strike Dec. 23, and, as a result, all street car traffic is suspended in Scranton, Carbondale, Forest City, Olyphant, Dunmore, Blakely, Priceburg, Archbald, Jermyn, Winton, Mayfield, Taylor, Moosic, Oldforge and Avoca. The strike is said to have been caused by the refusal of the company to accede to the demand of the men for a ten-hour day at 20 cents an hour for old employees, and a sliding scale of wages for new employees. So far there has been no violence, but the attempts of the company to operate cars have been futile. The employees, however, have threatened to boycott all who patronize the company's cars, and this has deterred many from riding.

Traction Litigation Ended

The litigation regarding the consolidation of the Consolidated Traction Company, United Traction Company, Southern Traction Company and the Monongahela Traction Company, of Pittsburgh, in which the Consolidated Traction Company and Whitney & Stephenson were involved, has been settled. The settlement clears the road for the consolidation of the properties, and, unless something new and unforeseen develops, there is every indication of the final consummation of the deal. The entire legal contest has been replete with sensational allegations and the outcome has been looked forward to with intense interest in legal and financial circles. Those interested in the settlement decline to make any statement regarding the terms of settlement.

Many Trolley Men Made Happy

Several days before Christmas the Boston *Transcript* asked the management of the Boston Elevated Railway Company if there was any objection to it making a public announcement that the employees of the company could receive any amount in excess of 5 cents in payment of fare by patrons of the road on Dec. 24, such excess to be retained by the conductor and divided with the motorman at the end of the day's work—a Christmas gift from the public. The company said that there was no objection to the plan, and the public at once entered heartily into the task of making the day one of good cheer for the men. Placards reading, "Don't Forget the Motormen," and others bearing similar inscriptions were placed in store windows and in prominent places throughout the city. The street car patrons were very liberal, and when the day closed there was not a conductor in the city who did not have a goodly sum to share with his motorman. In many other cities throughout the East similar plans for making the day a pleasant one for the motormen and conductors were adopted, and the returns from Reading, Philadelphia, Camden, Wilkesbarre and Shamokin show great liberality by the public. One of Camden's conductors was so fortunate as to receive $20, and a motorman and conductor at Wilkesbarre took in $35. It is estimated that the motormen and conductors in Philadelphia received $7 apiece.

Chester Traction Secures Important Lines

The Chester Traction Company, of Chester, Pa., has just completed arrangements for leasing the Philadelphia & Chester Railway Company and the Southwestern Railway Company for a period of 999 years. Under the lease the Chester Traction Company guarantees the interest on the bonds of the underlying companies and has placed their stock in its treausry. The Philadelphia & Chester Railway Company is capitalized at $350,000, and bonded at $350,000. The Philadelphia & Southwestern Railway Company is capitalized at $450,000, and bonded at $450,000. The leasing of these lines gives the Chester Traction Company a clear right of way from the heart of Chester to the southern boundary of Philadelphia at Third Street and Jackson Street, and Third Street and Tasker Street, from which points the run to Chester will be made in forty minutes.

New Tactics of the N. Y., N. H. & H. R. R.

The announcement is made that the New York, New Haven & Hartford Railroad Company is to equip its Waterbury, Middletown and Meriden road with electricity, using the third rail system, and that a similar change is contemplated on its Derby line. This is generally considered "an announcement," being believed to be a new method of fighting the proposed electric lines encroaching on its territory instead of opposing the roads in the Legislature. The method of the New York, New Haven & Hartford Railroad has been to oppose the granting of electric railway rights in the Legislature, and then to put every barrier in the way of the road if it finally succeeded in passing the Legislature. As a last resort, the New York, New Haven & Hartford purchased the road, if it was finally placed in successful operation.

Negotiations for the Consolidation at New Orleans

Negotiations are now being carried on for the purchase of the Orleans Railroad by the New Orleans & Carrollton Railroad Company. The latter company has, through its agents, secured an option on the majority of the stock of the Orleans Railroad Company, and the final consummation of the deal lies with the directors of the New Orleans & Carrollton Railroad, who will consider the matter shortly. In acquiring control of the Orleans Railroad, the New Orleans & Carrollton will secure a very valuable property. The system comprises 10.33 miles of track, with a well equipped power house and car houses. The system was converted and electrified by Ford, Bacon & Davis, of New York, and the lines extend to the Fair Grounds and City Park, places not now accessible by the lines of the New Orleans & Carrollton. This deal is supposed to be the first move in the consolidation of all the city lines.

Suit to Recover Return of Cars and Damages

Suit has been brought by the Jewett Car Company against the Indianapolis & Greenfield Rapid Transit Company, of Indianapolis, Ind., to secure $5,500 damages and the return of six cars now being operated by the company. The Jewett Car Company avers that the cars have not been paid for, and that they have been damaged to the amount of $5,500. The defense is that the Jewett Company has not fulfilled its contract, which required the delivery of eight cars March 1; that none were delivered until July 1, two in August, and two in September, and two are not yet delivered. By the terms of the contract $14,000 were to be paid for eight cars in instalments of $5,000, and that the Jewett Car Company was to forfeit $100 a day for each day after April 1 that cars were not delivered. The first $5,000 has been paid, and, when the forfeit money is deducted, nothing remains due the plaintiff, the secretary says. The suit promises to be interesting, especially the attempt to enforce the forfeiture clause of the contract.

Increase of Metropolitan Stock

Official announcement is made that $7,000,000 par value of the unissued authorized capital stock of the Metropolitan Street Railway Company, of New York, is offered for subscription to the stockholders at the price of $160 for each share of the par value of $100 upon the following conditions:

1. Each stockholder of record upon the books of the company at the close of business on Dec. 26, 1900, may subscribe for such number of shares of stock as will be equal to seven-forty-fifths of his holdings or any less part thereof.

2. Subscriptions must be in writing and must be delivered to the secretary of the company at the office of the company before 3 p. m., on Jan. 15, 1901, and subscribers must specify in their subscriptions their name and the full amount of stock standing in their name upon the books of the company.

3. Payments at the rate of $60 per share in cash or by check must accompany each subscription, and the balance at the rate of $100 per share must be paid on or before Jan. 30, 1901, whereupon stock certificates will be issued, except that for fractional parts of a share non-dividend bearing scrip will be issued for which, when presented to the secretary in amounts representing entire shares, stock certificates will be substituted.

4. Default in making the final payment will, at the option of the company, forfeit the subscribers' rights, both in regard to the stock subscribed for and in regard to the sum paid at the time of subscription.

The issue of new stock was authorized early in the year, and the purpose of the issue is to close out the floating indebtedness created by the purchase of the Third Avenue stock and by extensive improvements and changes in our own equipments.

New Car House and Power House at Chicago

The Chicago City Railway Company has completed negotiations for the purchase of fifteen acres of land at Seventy-Seventh Street and Vincennes Avenue, and for a tract of land at Halsted Street and Thirty-Eighth Street. The latter tract is 278 ft. x 376 ft. The plans of the company provide for the erection of a car house on the former tract to cost from $500,000 to $600,000; and for the erection of a power house on the latter tract to cost more than $1,000,000. The two power houses of the company will be consolidated into the new one, and the machinery in the three cable houses will be driven by motors fed from Thirty-Eighth Street and Halsted Street, instead of by steam, as at present.

D. G. Hamilton, president of the company, says, in reference to the purchase: "They were made in anticipation of the time when increased traffic will demand greater facilities. More and larger cars will have to be housed in the near future, and we bought the fifteen acres for that purpose before it was sub-divided. The Halsted Street tract is especially well fitted for our purpose, as it is on the railway and river, and advantageously located. No definite plans for either the sheds or power house have been drawn, and it may be a year or a year and a half before we begin work on either. Change of motive power is a matter that will undoubtedly come up with the renewal of franchises. If we are compelled to keep the cables we shall drive the machinery by electricity from the new power house in Halsted Street, and do away with steam power. If the power is changed to electricity the new plant will supply all the power direct. While I have always been a strong advocate of the cable, I believe an electric system throughout on the south side would meet conditions better. In any event we have now ground upon which to build such power house and sheds as we may need, no matter what power is ultimately decided upon."

Relations of the Street Railway and the Public

In a short article, under this title, in the Syracuse *Post-Standard*, E. G. Connette, vice-president and general manager of the Syracuse Rapid Transit Railway Company says:

"Street railways are quasi public corporations, or, in latter day phraseology, are 'public utility' corporations, and the nature of the enterprise should make the conditions existing between the street railways and the people of the most cordial nature. There should be a liberal and co-operative spirit on the part of the management and a proper appreciation and responsive sentiment on the part of the public.

"The car service should be attractive, convenient and comfortable, and the employees polite, attentive and courteous in the discharge of their duty. The frequency and regularity of the service is what the public most desire, and while the frequency should be extended to the furthest limit, still, like any other business enterprise, it must keep within the bounds of business prudence and discretion, and, therefore, must govern the frequency of its service by the income and increase it from time to time as the patronage may warrant.

"Under ordinary conditions a regular schedule can be maintained and the enterprising and intelligent manager realizes the importance of running cars so that his patrons may rely on the

time of cars to pass a given point, and even if the service is not very frequent, if people know 'when to catch a car' they are generally satisfied unless the cars are so few in number that they seldom have the pleasure of a seat; but the natural difficulties and impediments to a prompt and regular service are numerous which the public are loath to consider in forming an opinion of the car service.

"It is impossible for cars to always run on time when there are steam railroad grade crossings, canal bridges, wagons loading and unloading alongside of streets so as to obstruct the car tracks; wagons breaking down, cars occasionally becoming disabled and many other kinds of unavoidable obstructions to the maintenance of a regular schedule, but, as a rule, these delays are not frequent, and if the public would appreciate the difficulties and be charitable enough to credit the service when the cars are on time as cheerfully as they are inclined to find fault when they occasionally have to wait a few minutes for a car they would find that the balance was largely on the credit side of the ledger."

Mr. Connette then refers to the decentralization of population with the introduction of the electric railway, referring to the upbuilding of the suburbs, etc. Continuing, he says:

"With all the conveniences and advantages of rapid transit and a full realization that street cars are almost an indispensable commodity, there is sometimes an inclination to deal unfairly with street railways, perhaps because the management does not show a proper disposition to deal fairly with the people, but in most cases because a street railway is a corporation.

"People as a rule confound corporations with trusts and monopolies, and the prejudice that exists against corporations *per se* is unwarranted, unjust and wrong. Street railways may consolidate and in one sense resemble a trust, but a consolidation is always beneficial to the people, as it can only be done under the law which restricts the charge of one 5-cent fare from one point to any other point within the city limits, which gives the people a longer ride and accessibility to more parts for the same 5-cent fare.

"A mutual good feeling between the public and the street railways redounds to the interests of all concerned, and a happy, contented and satisfied state of mind produces a natural inclination to see the pleasant things of life."

Street Railways in Pennsylvania

Isaac B. Brown, superintendent of Railways of the Department of Internal Affairs of Pennsylvania, has just completed his report on the operation of the steam and electric lines of the State. In making his report, Mr. Brown speaks of the introduction of the automobile and the passing of the bicycle, but does not make any predictions as to the effect of the introduction of the former vehicle in competition with the electric railway. Continuing his report, Mr. Brown says, in part: "During the year there has been no material change in the financial or physical condition of the electric railways of Pennsylvania. The rapidity that characterized the development of these corporations a few years ago is no longer present, and there seems to be more stability in the financial conduct of these enterprises.

CAPITALIZATION

The total amount of outstanding capital stock of the operating street railways reporting for the year is $103,176,121. This amount comprises the stock of ninety-four companies. Last year the total amount was $103,122,319. The corporations whose capital stock makes up the greater portion of this amount are: Consolidated Traction Company, of Pittsburgh, $27,000,000; Union Traction Company, of Philadelphia, $10,499,912; United Traction Company, of Pittsburgh, $20,000,000. More than half of the total amount belongs to these three corporations, and $47,000,000 of it to the two corporations in Pittsburgh.

The total amount of funded debt reported for the year is $38,975,100. Last year the amount was $31,309,425. The Lehigh Valley Traction Company has bonds outstanding to the amount of $3,000,000; Pittsburgh & Birmingham Traction Company, $1,500,000; Scrantan Railway Company, $3,000,000; United Traction Company, of Pittsburgh, $10,000,000; Wilkinsburg & East Pittsburgh Street Railway, $2,000,000; Wilkesbarre & Wyoming Valley Traction Company, $1,819,000; making $21,319,000, or more than one-half the entire amount of funded debt outstanding.

The total amount of current liabilities for the year is reported at $11,585,004, making the total street railway capitalization of operating companies $153,736,225. If to this amount be added the capital stock outstanding amounting to $68,094,525, and the funded and unfunded indebtedness of the companies whose lines are subsidiary to or operated by other corporations, amounting to $21,764,354, the total capitalization is found to be $243,595,104. As the total mileage of these corporations is 1654, the capitalization per mile of road is $147,276, or over double the capitalization per mile of road of the steam railways of the United States.

The assets of street railways are classified as follows: Total cost of road, cost of equipment, stock owned, bonds owned, cash and current assets, other assets, total assets. The total cost of roads as reported for the year is $87,806.26. The companies contributing most largely to this amount are the following: Conestoga Traction Company, of Lancaster, $3,401,100; Consolidated Traction Company, of Pittsburgh, $3,582,642; Monongahela Street Railway, of Pittsburgh, $2,079,418; Pittsburgh & Birmingham Traction Company, $1,372,288; Pottsville Union Street Railway, $1,498,062; Scranton Railway Company, $4,570,535; United Traction Company, of Pittsburgh, $29,575,641. The latter amount, however, includes cost of equipment, as this company for some reason or other fails to divide the cost of road and equipment in a manner that will show the separate accounts. Union Traction Company, of Philadelphia, $1,899,252; West End Traction Company, of Pittsburgh, $5,526,691; Wilkinsburg & East Pittsburgh, $2,942,414; Wilkesbarre & Wyoming Valley Traction Company, $6,645,943. The total cost of road last year was $87,411,512.

The total cost of equipment reported for the year is $12,334,380. Last year the amount was $9,128,533, but the cost of equipment of the Consolidated Traction Company, of Pittsburgh, is not included in this amount.

The total amount of assets reported for the year is $156,368,465. Last year the amount was $149,934,302. By adding the assets of subsidiary companies, or those whose lines are operated by other corporations, amounting to $80,186,452, it will be seen that the total assets of the street railway corporations of Pennsylvania are $236,554,917.

INCOME

The total income of all the street railways in Pennsylvania during the year was $24,477,181. Last year the amount was $22,569,256. There are several large steam railroad corporations in the State whose receipts from operations fall considerably below the receipts of some of the street railway companies. When it is understood that the source of revenue of these corporations is practically from passengers alone, and that the amount received from each passenger is very small, the total income seems exceedingly large. Few industries have increased their receipts with the same velocity as the street railways. They have certainly become a very important interest in the commercial world.

Relative to the income and expenditures of street railway corporations, it is of interest to compare the operations of one of these street car companies with others that are similarly located. It would be unreasonable to compare a street railway in Harrisburg with the Union Traction Company, of Philadelphia, or the Consolidated Traction Company, of Pittsburgh, but there is interest in comparing the street railways of the Commonwealth whose capitalization, mileage, income and expenditures are similar. A table has been arranged, and is published herewith, relating to the Harrisburg Traction Company, Lehigh Valley Traction Company, Scranton Street Railway Company, and Wilkesbarre & Wyoming Valley Traction Company, showing the capital stock, bonds and current liabilities of each; also the total capitalization, the mileage operated, the income per mile of road, the expenditures, the expenditures per mile of road, the net income per mile of road, the percentage of expenditures to income, and the gross dividends.

TABLE SHOWING CAPITAL STOCK, BONDS, CURRENT LIABILITIES, TOTAL CAPITALIZATION, MILEAGE OPERATED OF FOUR COMPANIES, WITH GROSS AND NET RECEIPTS PER MILE OF ROAD, PERCENTAGE OF EXPENSES TO RECEIPTS AND DIVIDENDS PAID.

	Capital Stock	Bonds	Current Liabilities	Total Capitalization	Mileage	Income	Expenses Exclusive of Dividends	Income Per Mile of Road	Percentage of Expenses to Income	Dividends Paid	Expenses Per Mile of Road	Net Income Per Mile of Road
Harrisburg Traction Co.	$2,000,000	$75,000	$47,069	$2,122,069	40.50	$368,645	$272,147	$9,102	73.82	$100,000	$6,720	$2,382
Lehigh Valley Traction Co	1,700,000	3,000,000	357,017	5,059,017	51 89	328,676	273,027	6,334	83 37	------	5,242	1,092
Scranton Railway Co.	3,000,000	3,000,000	139,885	6,139,885	73.78	464,807	411,450	6,290	88.52	------	5,576	714
Wilkesbarre & Wyoming Valley Traction Co.	5,000,000	1,819,000	233,360	7,052,360	64.00	574,645	445,751	8,978	77.57	150,000	6,964	2,014

DISBURSEMENTS

The total amount expended for operations during the year was $12,114,609, as against $10,519,810 last year. Of this amount the Consolidated Traction Company, of Pittsburgh, paid $1,341,565; and the Union Traction Company, of Philadelphia, paid $5,624,898.

The total amount of taxes paid during the year was $1,579,284. Last year the amount was $1,314,470. The increase in this amount is, no doubt, due to the increased valuation of the capital stock, the 5 mill tax being based on the market or appraised value of the stock. During the last two or three years there has been a marked increase in the market value of all kinds of stocks, but no material increase in the par value. While it is known that the street railways are an important factor in the commercial world, it would also seem as if they were an important factor as a source of revenue for the maintenance of the State government.

The rentals paid during the year amounted to $5,954,232. Last year the amount was $6,237,691.

There was paid during the year $398,326 for other expenses. Last year the amount was $279,453.

Of the total number of operating companies there are only twenty that pay dividends. They are the Beaver Valley Traction Company, $6,000; Chester Traction Company, $2,500; Connellsville, New Haven & Leisenring Street Railway, $1,750; Connellsville Suburban Street Railway, $5,000; Consolidated Traction Company, of Pittsburgh, $649,806; Delaware County & Philadelphia Street Railway, $36,000; Harrisburg Traction Company, $100,000; Holmesburg, Tacony & Frankford Street Railway Company, $10,500; Johnstown Street Railway, $23,193; People's Street Railway Company, of Nanticoke and Newport, $2,000; Pittsburgh & Birmingham Traction Company, $90,000; Roxboro, Chestnut Hill & Norristown Street Railway, $15,872; Stroudsburg Street Railway, $1,384; Tamaqua & Lansford Street Railway, $5,000; United Traction Company, of Pittsburgh, $150,000; United Traction Company, of Reading, $24,000; West End Traction Company, $125,000; Wilkesbarre, Dallas & Harveys Lake Street Railway, $6,000; Wilkesbarre & Wyoming Valley Traction Company, $150,000; York Street Railway Company, $6,552. There are fifty-three subsidiary companies that report payment of dividends, which, of course, is derived from rentals received. The amount of such dividends is $5,427,590.

The total disbursements for the year were $23,976,312, as against $21,788,663 last year. This amount includes all dividend payments.

EQUIPMENT, MILEAGE, NUMBER OF PERSONS EMPLOYED AND PASSENGERS CARRIED

The total mileage of the street railways of Pennsylvania is 1654, as against 1493 reported last year, an increase of 160 miles. The total length of all tracks, including sidings and switches, is reported for the year as 1898.69 miles. Last year the total was 1812.94 miles. These figures indicate that the mileage of the street railways is materially increasing.

The total number of cars in the service of the street railways of Pennsylvania during the year was 6395. Last year it was 5864, a material increase. The total number of employees reported for the year is 14,798. Last year it was 12,506. The total amount paid to street railway employees during the year was $8,043,589. Last year the amount was $6,569,204. The total number of passengers carried during the year was 538,194,532. Last year the number was 473,313,258.

STREET RAILWAY ACCIDENTS

As the result of the operation of the street railways during the year twenty-eight passengers were killed, as against seventeen last year. This is at the rate of one passenger to each 19,221,233 carried. The total number of passengers injured was thirty-three. There were only six employees killed during the year. One to each 2499 in the service. Last year the number killed was three. During the year ninety-four employees were injured. One in each 157. These figures indicate very clearly that the hazard for employees is not nearly so great on the street railways as on the steam roads, as one employee in every twenty on the steam railroads was injured. During the year 107 persons other than passengers or employees were killed. Last year the number was seventy-seven. These persons were run over by the cars, or in some other way lost their lives in connection with the operation of the street railways. During the year 567 persons other than passengers or employees were killed. Last year the number was 504. The total number of persons killed during the year was 141. Last year the number was ninety-seven. The number injured was 1441; last year 1127. The total number killed and injured for the year was 1582.

Franchise Discussion in Columbus, O.

During the discussion, still being carried on in Columbus, Ohio, on the question of franchise renewals, the Columbus *Journal* published certain statements, claiming the street railway company was making large profits, and could afford to make greater concessions than it had proposed. R. E. Sheldon, president of the Columbus Railway Company, refuted these statements in a letter in the *Dispatch* of Dec. 12. This letter was such a powerful argument in favor of the company's proposition that it is published in full below:

LETTER OF MR. SHELDON

In an article in Thursday morning's *State Journal*, 6th inst., the editorial writer refers to the fact that the Columbus Railway Company recently gave out a statement showing as a result of its year's operation, that it had paid 5 per cent upon its $3,000,000 of preferred stock and had a surplus of $47,000, and dwells upon the fact that this is a large sum of money to carry into surplus earnings account.

If additional reasons were necessary, the statement ought to be a strong argument in favor of an adjustment of the franchise question, and doubtless will to the thinking public. There is not a manufacturing concern in our city, or a private business house, that would think of entering into a business if the percentage of surplus on its capital were sure to be so meagre. Forty-seven thousand dollars is a sum that might be wiped out twice over any hour of the day by an accident. Even if the hazard of our business, which is enormous, were not considered, the placing of 1½ per cent to surplus earnings is an exceedingly small quantity when it is remembered that we have made a proposition to the city, whereby that amount might be entirely absorbed, and an actual deficit occur, as the result of our offer to sell twenty-eight tickets for $1, a sum that would net us, if all availed themselves of our offer, a little over 3½ cents per ticket.

As we said in a former communication, we feel that we are taking a great risk, and no one can foretell the result upon the company's earnings. Our proposition to the city, for reasons over which the board had no control, owing to the frequent changes which have occurred during the past six months, has lain dormant. We have made no haste in the matter, and the authorities as well as the people had had ample time in which to consider a proposition that we consider most fair toward both patrons and the city, and yet when it is known that a franchise is being prepared by the Board of Public Works, this paper comes forward and seeks to prevent the consummation of any agreement by naming a sum to be paid and terms to be granted that it knows the company can not and will not accept.

In a recent case tried in New York, the testimony of manufacturers and jobbers of merchandise was taken, and the consensus of opinion was that business men would not engage in business unless they were reasonably assured of profits of 15 per cent as reasonable remuneration for capital, time and the risks incident to business. We doubt if the Ohio *State Journal* company considers 15 per cent an unreasonable sum, either on its capital or that of its advertisers engaged in business in this city.

It magnanimously concedes that there may be $3,500,000 invested in this railway with its 100 miles of trackage, all its equipment, its power plant and real estate. We doubt if any manufacturing plant or business house in this city, with a capital of $1,000,000 would be satisfied with the returns that came to the Columbus Railway management through the $3,500,000 the *Journal* claims this plant might be replaced for.

Our reason for replying to such articles is that they are calculated to disturb readers who have not fully considered the risk attending the care of the large concerns, and might feel that the statements are reasonable. Manufacturers, business men and others, however, who realize the responsibility attaching to the management of the larger organizations, know that the Columbus Railway Company's proposition is exceedingly fair.

If those in authority are not disposed to grant a renewal of the franchise upon the terms of our proposition, we can continue to operate as now organized, but it is needless to say that it would be to the profit and convenience of many thousands of people daily, whom we might serve more acceptably and at cheaper rates of fare, if the roads were properly joined and our system perfected and extended according to our plans.

We take this opportunity to again call attention to the giving to patrons under our twenty-eight tickets for $1 proposition. We are now carrying 20,000,000 of passengers annually. At the average received in 1899 (4.58) this would amount to $916,000, and at twenty-eight tickets for $1 (or 3.57 each) to $714,000, a difference of $202,000. So, if patrons avail themselves of the rates thus offered, it will be found that in fourteen years, even if there should be no increase in the number of passengers carried, this would

amount to a saving to our patrons of $2,828,000, or over $550 daily. We have made the above calculations upon the basis of fourteen years only, but call attention to the fact that if the franchise for the period of twenty-five years is renewed, the saving to the public upon the above basis between the average received by the company last year and that which would be received at twenty-eight tickets for a dollar, would amount to the enormous total of $5,050,000.

We do not wish to be considered arbitrary, but under all the circumstances and in justice to the stockholders of the company, and a proper regard for the citizens of Columbus who demand a high standard of operation, we can not consent to a rate that would necessitate the curtailment of the service, wages, or the character of the plant. We have a natural pride in our system, and while willing to meet, so far as we can, the wishes of all concerned, we can not consent to terms and conditions that will result in either a deterioration of the property or a loss to its owners.

With about fourteen years remaining of our rights upon our principal lines, during which time we are not obliged to make the slightest concession in fares, nor even issue a transfer, as we now do voluntarily, we are willing to begin immediately to give the public the benefit of a lower rate of fare than is in force on the street railway system of any similar city in the United States.

A comparison between Columbus and the other cities of the country of 100,000 and over in population will show that none can compare with Columbus in excellence of service and cheapness of fares.

In the *Journal's* "Blanket" article of inaccurate and misleading figures in its Sunday issue not a word was written by its mathematician about the vast sum, amounting to at least $2,000,000 in the fourteen years yet remaining of our grant, it may cost this company by our offer to establish the low fares at once. If the expert mathematician will be good enough to give us credit for these $2,000,000 that this community may save, to apply on the eleven years renewal we ask (for eleven years is all we ask renewal for), then the absolute fairness of our offer must be apparent to every patron of our company.

In its Sunday article, the *Journal* indulges in prophecy, and is most optimistic. It estimates that Columbus will contain in 1920 a population of 200,000, and that the gross receipts of the Columbus Railway Company will amount to $2,240,000, and makes the further claim that the company will be able to operate its system as low as 44 per cent. Let us see what the facts are, as against theories. Taking the receipts and operating expenses of street railway companies in cities approximating 200,000 population, as found in the 1900 edition of the American Street Railway Investments, published by the STREET RAILWAY JOURNAL, an acknowledged authority in all matters pertaining to street railway matters, and ascertain the facts:

LOUISVILLE, KY.

Present population, 204,731. Mileage, 140.

Gross receipts	$1,436,828
Operating expenses (66.4 per cent)	954,573
Net	$482,255

Louisville has a population of 4,731 more than the *Journal* claims for Columbus in 1920, yet the receipts for 1899 were $1,436,828, or $803,170 less than the *Journal* estimates that the receipts of the Columbus Railway Company will be in the year 1920.

ROCHESTER, N. Y.

Present population, 162,435. Mileage, 102.

Gross receipts	$874,983
Operating expenses (58.8 per cent)	515,237
Net	$359,746

Note that this is practically same mileage as Columbus, and the identical 37,000 increase in population claimed by the *Journal* that Columbus may have in 1910.

DETROIT, MICH.

Present population, 285,704. Mileage, 163. "Citizens" and "Detroit" combined.

Gross earnings	$1,496,188
Operating expenses (54.2 per cent)	810,827
Net	$685,361

Detroit has a population of 85,704 more than the *Journal* claims for Columbus in 1920, yet the receipts for 1899 were $1,496,180, or $743,820 less than the *Journal* estimates that the receipts of the Columbus Railway company will be in the year 1920.

NEW ORLEANS, LA.

Present population, 287,104. Mileage, 162. The combined systems of "New Orleans," "N. O. & Carrollton" and "St. Charles."

Gross earnings	$2,198,336
Operating expenses (57.7 per cent)	1,270,491
Net	$927,845

New Orleans has a population of 87,104 more than the *Journal* claims for Columbus in 1920, yet the receipts for 1899 were $2,198,336, or $41,664 less than the *Journal* estimates that the receipts of the Columbus Railway Company will be in the year 1920.

MILWAUKEE, WIS.

Present population, 285,315. Mileage, 141. The Milwaukee Electric Railway & Light Company.

Gross earnings	$2,007,139
Operating expenses (51 per cent)	1,026,403
Net	$980,736

Milwaukee has a population of 85,315 more than the *Journal* claims for Columbus in 1920, yet the receipts for 1899 were $2,007,139, or $232,861 less than the *Journal* estimates that the receipts of the Columbus Railway Company will be in the year 1920.

It may be of interest to give just here the terms of the franchise just granted to the Milwaukee Electric Railway & Light Company.

The company offered to the city for a grant to run thirty-six years $50,000 per year for the first year, and $10,000 additional each year until the sum should reach $100,000. The company was to pay $100,000 annually for the remaining thirty years. The Council refused the offer, but granted a franchise upon the following terms, as being in the interest of the citizens, viz., fare, 5 cents with transfer privileges. One hour in the morning and one hour in the evening; tickets to be sold in packages of twenty-five for $1. After five years the company to sell on demand, at all hours of the day, packages of twenty-five for $1. These terms our patrons have enjoyed for many years. We now offer, not waiting five years, or any term, twenty-eight tickets for $1, at all hours of the day.

A "taxpayer" obtained an injunction in the court at Milwaukee to prevent the enforcement of the contract. It was taken to the Supreme Court of Wisconsin, and on Oct. 13, 1900, the case was decided in favor of the company, the court holding that the contract was a fair one and favorable to the citizens. We quote this language of Justice Winslow on this point:

"The defendant company in the year 1898 offered to pay the city annually on the 1st of January of each year a large sum of money, beginning with $50,000, and increasing the sums each year by $10,000, until it reached $100,000 annually, on condition said city would grant the right to charge 5-cent fares until the year 1935. These offers were, however, rejected by the city, and the present ordinance adopted, by the terms of which no moneys are to be paid to the city, but the company is required to sell twenty-five tickets for $1, good for travel during certain morning and evening hours until Jan. 1, 1905, and after that time good during all hours of the day.

"It seems very plain to us that this action of the Council cannot be called in any proper or reasonable sense a squandering of public funds or property."

If the Supreme Court of Wisconsin finds that twenty-five tickets for $1, after five years, is fair and equitable to Milwaukee, is not our proposition to give twenty-eight tickets for $1 to our patrons, beginning at once, a generous one? Chief Justice Winslow considered twenty-five tickets for $1, after five years, better than $100,000 annually paid to the city.

BUFFALO, N. Y.

Present population, 352,219. Mileage, 164.66. Buffalo Railway Company.

Gross earnings	$1,728,653
Operating expenses (51.6)	892,088
Net	$836,565

Buffalo has a population of 152,219 more than the *Journal* claims for Columbus in 1920; yet the receipts for 1899 were $1,728,653, or $511,347 less than the *Journal* estimates the receipts of the Columbus Railway Company will be in the year 1920.

The above comparisons will be found interesting, and will show clearly the fallacy of the *Journal's* figures.

In closing, let us take the two cities of Toledo, Ohio, and Worcester, Mass., more clearly approximating in size and general conditions that of Columbus.

TOLEDO, OHIO

Present population, 131,822. Toledo Traction Company.

Gross earnings	$1,006,384
Operating expenses (54.3)	546,356
Net	$460,028

WORCESTER, MASS.

Present population, 118,421. Worcester Consolidated Street Railway Company.

Gross earnings	$610,153
Operating expenses (71.9)	439,160
Net	$170,993

It will be observed that in the larger cities the percentage of operations is higher than in Columbus, and there are no grounds for the claims of the *Journal* that the operating expenses of our system will decrease, however gratifying such results might be to the management.

Safety Regulations for Street Railway Installations

As has been previously reported in the Street Railway Journal, a commission of the Verband Deutscher Elektrotechniker has been in existence for a year, whose duty it is to devise regulations suitable for electric street car installations. This commission made little headway until a committee, consisting of practical men, was appointed by the Verein Deutscher Strassenbahn- und Kleinbahn Verwaltungen, when the following rules were laid down, which now have to be conformed to by the various companies. As yet the question of grounding the apparatus in the car has not been decided, but with the exception of this still open question the rules have been adopted for a trial period of one year.

All new installations have to conform to these rules, but it is optional with the road managements to make the necessary changes on existing roads. After the trial period, any shortcomings which have suggested themselves, will be remedied, and then the rules will probably be put into the form of a law, and passed.

The following rules for electric railway installations are intended for overhead systems, as well as accumulator traction, for pressures between 250 volts and 1000 volts. If this voltage is exceeded, the high tension regulations apply.

POWER STATIONS

Sec. 1.—For railway power stations the mean pressure regulations for central stations are applicable. The car houses are considered as a part of the power station.

CONDUCTORS

Sec. 2.—For railway conductors the mean pressure conductor regulations are applicable, with the following exceptions:

a. For railway circuits weatherproof-covered wires are permitted to be freely strung.

b. Trolley wires and feeders which are not supported on double porcelain insulators must be doubly insulated from the ground.

c. Wires must be strung at least 5 m above the street surface. A smaller height is permitted where the circuit passes under a structure or through a tunnel, but safety regulations and a warning sign must then be provided.

d. Electric roads having their own roadbeds, which are inaccessible to the public, can suspend their wires any desired height above the track, if the employees receive proper instruction as to the dangers involved. At stopping places or crossings the wires must be guarded, and danger signs be put up.

e. Lengths of spans must be so chosen that supports of wood have a safety factor of ten, those of iron a factor of four, and wires of 20 degs. Cels. a factor of five. Hard-drawn copper need only have a factor of safety of three. The wind pressure is taken as 125 kg when acting vertically on 1 sq. m of surface.

f. The freely suspended wires are to be protected by lightning arresters, which remain operative even if repeatedly struck by lightning. They must be well grounded, all curves being avoided. The rails may be used for ground returns.

g. All bare conductors in streets that are inhabited must be arranged in sections, which can be cut in and out separately.

h. In regard to the protection of existing telegraph and telephone lines the telegraph law of April 6, 1892, must be obeyed.

Sec. 3.—Trolley wires are not subject to the regulation which requires tension to be removed at branch or terminal points of freely suspended conductors; but it is necessary to anchor the same rigidly to the frog or switch wherever a joint or branch occurs.

Sec. 4.—The insulation resistance of overhead conductors must be at least 50,000 ohms per km, measured in rainy weather and at the working pressure. Every six months measurements must be taken, in which each feeder, with its corresponding section of trolley wire, form a separate circuit. The measurements must be recorded in books, and preserved.

Sec. 5.—Work must only be done on live wires by experienced workmen, who are stationed on an insulated tower wagon or ladder. Two workmen must always work together, so that they might render assistance to each other in case of need.

Sec. 6.—If the rails are used as return conductors, the negative pole of the generator is to be connected to the track by means of insulated cables.

III. ROLLING STOCK

Sec. 7.—*a.* Insulation. An insulation is considered satisfactory if it does not break down under a pressure exceeding that used in service by 1000 volts. In addition, the insulating material must be of such a nature that under ordinary conditions there will be no surface leakage. In the controller impregnated wood is permissible as insulating material.

b. Grounding. The electrical connection between wheels and truck is a satisfactory ground connection.

c. Insulated conductors must have the ability to stand an excess of pressure of 100 volts for one hour after the wire has been immersed in water for twenty-four hours.

d. Fireproof apparatus. Any piece of apparatus which cannot be ignited, or which, after ignition, will not continue to burn, is considered fireproof.

Sec. 8.—Generators, motors and transformers. The frames and supports of stationary generators, motors and transformers must be permanently grounded. The machines must be so set up and protected that persons cannot touch parts which carry current or are in motion. They must be so set up that if fire should break out it cannot ignite any combustible material.

Sec. 9.—Accumulators. Accumulators can be set on wood, if non-hygroscopic insulators are employed. The public must have no access to the battery during ordinary service. Celluloid must not be used for jars or battery boxes.

Sec. 10.—Switchboards. Wood may only be used as supports for switchboards in or on the cars. Current-carrying parts and such apparatus which emit sparks during operation must be mounted on fireproof bases, and must be so placed that the sparks cannot injure persons or set inflammable material on fire.

Sec. 11. Conductors. *a.* The cross-section of all conductors within the car must bear the following relation to the fuse protecting them. This also applies to conductors for the braking mechanism:

Cross-section in sq. mm	Normal current rating of fuse	Cross-section in sq. mm	Normal current rating of fuse
0.75	2	35	80
1	4	50	100
1.5	6	70	130
2.5	10	95	165
4	15	120	200
6	20	150	235
10	30	185	275
16	40	240	330
25	60	..	..

b. Insulated conductors must have a covering of rubber, in the form of a continuous, seamless and watertight sleeve. This rubber must be protected by a cotton covering.

c. Stranded conductors are permitted, if each conductor is treated as stated in *b.* The cotton covering, however, may be woven over the entire number of bunched conductors.

d. When vulcanized rubber insulation is used the wire must be tinned.

e. Bare conductors can only be used to connect the several cells or portions of resistance frames, but they must be supported on insulators and protected against contact.

f. Insulated conductors must be so placed that the heat of adjoining resistances will not destroy the insulation.

g. All stationary conductors are to be so run that they are accessible only to the employees and not the public.

h. Wires must only be jointed to each other by means of a soldered, screwed or similarly effective joint. Twisted joints are prohibited, and no acids are allowed for soldering purposes. The joint must be carefully insulated.

i. The joints between conductors and apparatus must be soldered or screwed. Cables above 6 sq. mm, and wires above 25 sq. mm, in section, must have cable terminals at their ends. Cables not provided with terminals must be soldered at their ends.

k. Parallel running conductors must either be protected by means of a common watertight cover, so that a movement of or contact between them is impossible. The place where the wires come out must be made watertight. The wires may also be

separated by insulators, and be run through insulating tubes when passing through walls or floor.

l. Insulated wires may be run in wooden molding.

m. Connections between motor car and trailer must be made in such a manner that the public cannot possibly come in contact with them. Movable couplings must be covered with insulating material, so that even if the contact piece should fall to the ground it could not cause trouble.

n. Conductors which undergo much bending or turning must be made flexible, and be provided with a rubber tube, slipped over the insulation.

o. When in close proximinity to metal parts insulated conductors are to be covered by a dampproof insulating tube. In this case the grounding and the connecting of metal parts is not inisisted upon.

p. Clamps are permitted solely for connecting bare wires permanently to the frame of the car.

g. Insulated wires on walls, ceilings and floors may be run through tubes if the latter protect the wires against moisture. They may be made of metal or moisture-proof insulating material, or lined metal tubing. In the case of a single or polyphase system the wires of the same circuit must be grouped together in one tube. Connections must be made only in junction boxes, which can be opened at any time. The tubes must be so constructed that no protruding parts can injure the insulation of the wires. The metal tubes must be connected electrically and grounded. The tubes must be so laid that water cannot accumulate at any point.

SEC. 12.—Apparatus. Those parts of apparatus which carry current which may be touched accidentally must be surrounded by covers. The contacts are to be of such a size that in service they do not attain a temperature exceeding 50 degs. C. above the surrounding air.

SEC. 13.—Controller. The handle of the controller must be removable only when the current is off.

SEC. 14.—Fuses. *a.* Each motor car must have at least one main fuse in the motor circuit. Separate fuses must be placed in the lighting, heating and accumulator circuits. There is to be no fuse in the circuit of the short-circuit brake.

b. The fuses, including the automatic circuit breakers, must be so constructed that during operation (even short circuit) there can be no permanent arc. The fuses must be provided with copper terminals when the fusing metal itself is soft. The maximum pressure and normal current rating must be stamped on the fuse.

c. The fuses must be so arranged that in case they blow they will not be a source of danger to the passengers, nor be able to set fire to any adjoining inflammable substances.

SEC. 15.—Switches. The lamp circuit, the heating circuit and the accumulator circuit must all have their individual switch. The latter must be so constructed that no permanent arc can be maintained, and give a plain indication whether the current is on or off. Knife contacts only will be permitted. Switches must be so placed as not to endanger the passengers nor be able to set fire to neighboring inflammable substances. Handles and cases must be made of insulating material.

SEC. 16.—Resistances. Resistances and heating coils must be so arranged that contact between the heated apparatus and inflammable material is impossible. Too great a rise in temperature of the latter must also be avoided. The current-carrying parts must not be accessible to the public while in service.

SEC. 17.—Lamps and Accessories. The current-carrying parts of the lamps must be protected by an insulating covering. The socket may have a fireproof base, and parts which may be ignited or have their shape changed when heated, must not be placed within sockets. For arc lamps the ordinary mean pressure regulation is applicable.

SEC. 18.—The Verband Deutscher Elektrotechniker reserves the right to make such changes or additions to these rules as may be deemed advisable.

BOSTON, MASS.—The Railroad Commissioners have granted the petitions of the Boston Elevated Railway for the removal of its horse car tracks on Dartmouth, Marlborough, Arlington and Beacon Streets. The Commissioners in their decision relative to the removal of the Back Bay horse car tracks state that the car service on this line has been substantially substituted by electrics on Boylston Street, Massachusetts Avenue and Charles Street. Increased service to residents in that vicinity is guaranteed by an agreement made by the company to introduce a new line of electric cars to run through Boylston Street from a point beyond Massachusetts Avenue to the Northern Station by the way of Charles and Cambridge Streets, to run every fifteen minutes. In closing their decision, the Commissioners say: "The introduction of additional cars on Boylston Street will not tend to appreciably hasten the day, for obvious reasons near at hand, when provision must be made for other through service from the suburbs to the centers of the city. With these tracks removed, the question of future facilities can be taken up and treated without embarrassment or prejudice."

Street Railway Patents

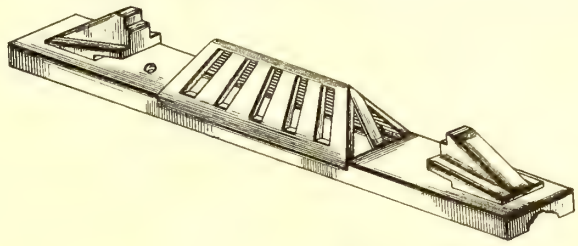
[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED DEC. 18, 1900

663,872. Railway Switch; C. A. Dunn, Denver, Col. App. filed Dec. 11, 1899. A device operated by the motorman for throwing the switch tongue, and at the same time cleaning out the rail.

663,882. Rail Connection for Railways; W. C. Gregg, Honolulu, Hawaii. App. filed March 22, 1900. A novel form of shoe or cradle receiving the ends of the rail.

663,894. Rail-Joint; A. G. Heinle, Esplen, Pa. App. filed May 16, 1900. A wedge-shaped recess is formed by the meeting of the rails, into which a wedge projection from the fish-plate extends.



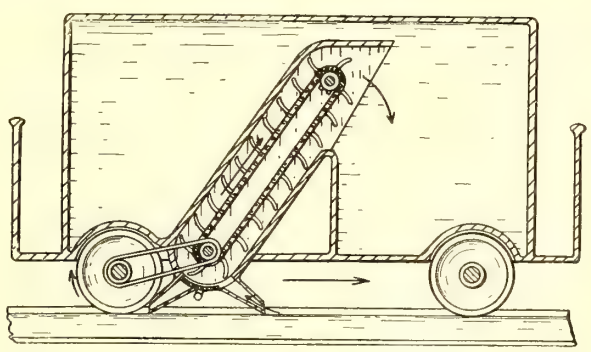
PATENT NO. 664,042

663,958. Brake-Shoe; J. H. Cardwell, Chicago, Ill. App. filed Aug. 10, 1899. The insert plate and shoe-frame are dovetailed together and formed with strengthening parts.

664,020. Metallic Railway Track Construction; G. B. Harper, Menoken, Kan. App. filed April 13, 1900. String plates under the rails are connected together by channel iron, which also secures the flanges of the rail.

664,042. Metallic Railway Tie; W. H. Hillyer, Freeport, Ohio. App. filed March 23, 1900. The middle portion of the tie is formed with a pyramidal projection for stiffening purposes and to prevent walking on the ties.

664,103. Fare Registers; J. O. Sloan, Indianapolis, Ind. App. filed April 2, 1900. A device carried by the conductor, into which passengers insert their fares. The conductor, by pressing a button, first records the fare and then sounds a bell notifying the passenger that the fare has been received and recorded.



PATENT NO. 664,165

664,165. Means for Cleaning Tramway Rails; O. Michaelis, Berlin, Germany. App. filed June 18, 1900. A cart with an endless carrier adapted to take up the dirt, regardless of the direction in which it travels, of over the rails and without shifting the position of the carrier.

664,199. Rail-Joint; S. B. Wharton, South Bend, Ind. App. filed March 27, 1900. A nut-lock bar is held in position against all of the nuts by engagement with the rail chair.

664,309. Car Fender; P. Best, Elizabeth, N. J. App. filed March 22, 1900. Details.

PERSONAL MENTION

MR. DAVID HYMAN has been elected manager of the Ithaca Street Railway Company, of Ithaca, N. Y.

MR. D. H. LOUDERBACH has just returned from London, Eng., where he represented Mr. Charles T. Yerkes.

MR. E. L. FULLER, of Scranton, Pa., has been elected president of the Ithaca Street Railway Company, of Ithaca, N. Y., to succeed Mr. E. G. Wyckoff, resigned.

MR. A. B. DU PONT, general manager of the Detroit Citizens' Street Railway Company, has been elected to the newly created position of second vice-president of the St. Louis Transit Company. Mr. du Pont will assume his new duties Jan. 1.

MR. H. E. BRADFORD, who recently resigned as general manager of the Marlboro Street Railway, Framingham Street Railway, Southboro & Marlboro Street Railway, and Framingham Union Street Railway Companies, to devote his entire attention to the interests of the Worcester-Boston syndicate, which now controls some 140 miles of road, centering in Worcester, Mass., was tendered a banquet and reception by his late employees, Dec. 4. The reception was held at the Gleason House, Marlboro, Mass., and the affair was a most enjoyable one, all but three employees being present. Mr. Henry W. Angier acted as toastmaster, and after making a few complimentary remarks regarding the efficient manner in which Mr. Bradford managed the street railways under his charge for the past thirteen years, presented him, in behalf of the employees, with a solitaire diamond ring. Mr. Bradford responded with an extended speech, full of practical points for the welfare of his late fellow employees. Mr. Bradford is president of the New England Street Railway Club, and first entered street railroading in 1888, when he entered the employ of the Marlboro Street Railway Company. He was born in Keene, N. H., in 1858, and was apprenticed as a machinist, serving eleven years at the trade. Mr. Bradford came to Marlboro in 1883, and entered the employ of Gen. Henry Parsons. He resigned this position after a few months, and accepted the position of master mechanic and chief engineer for the Boyd-Cory Shoe Company, the largest shoe manufacturers in the city. He resigned this position to accept a minor one with the Marlboro Street Railway Company. By perseverance and attention to duties he secured advancement, and is well fitted for the position to which he is now chosen.

H. E. BRADFORD

MR. A. C. RALPH, who has recently been appointed superintendent of the Marlboro Street Railway, Framingham Street Railway, Southboro & Marlboro Street Railway, and Union Street Railway Companies, of Marlboro, Mass., to succeed Mr. H. E. Bradford, who has entered the employ of the Worcester-Boston syndicate, was born in Warren, Vt., in 1854. After attending the public schools, and graduating from the Vermont Normal School, he followed various occupations, such as school teacher, clerk in a country store and traveling salesman until after the West End Street Railway Company took charge of all the Boston roads. When this deal was consummated he entered the employ of this company as a driver, and was one of the first men to act as a motorman when the electric cars were first installed on the ninth division of that system. His knowledge of the electric system was so apparent that he was shortly appointed foreman of the Grove Hall car house of the company, where he remained three years. This position he resigned to go to Knoxville, Tenn., in the interest of the Thomson-Houston Company, and he resigned the latter position to become master mechanic of the Atlanta Consolidated Street Railway Company, of Atlanta, Ga., where he remained for a year. He then accepted the position of master mechanic of the Paterson Street Railway Company, of Paterson, N. J., which position he held for four years. During the construction of the Brockton Street Railway and the Bridgewater & Brockton Street Railway, under Mr. James F. Shaw, Mr. Ralph acted as superintendent of construction in connection with his duties as superintendent of the Brockton & East Bridgewater, Bridgewater, Whitman & Rockland, Providence & Taunton and the New Bedford, Middleboro & Brockton Street Railways, which were at that time controlled by Mr. James F. Shaw, but have since passed into the hands of the Massachusetts Electric Companies, and form a part of the Brockton & Globe Street Railway systems. Mr. Ralph's success can be attributed to hard work and strict attention to business, and no one appreciates this fact better than Mr. Shaw, who has appointed him superintendent of three street railway lines which he now controls.

A. C. RALPH

ENGINEERING SOCIETIES

NORTHWESTERN ELECTRICAL ASSOCIATION.—The annual meeting of this association will be held at Milwaukee, Wis., Jan. 16-18.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF NEW YORK.—The annual meeting of this association will be held at Utica, Jan. 15.

FRANKLIN INSTITUTE.—The annual meeting of the mechanical and engineering section of the institute will be held Jan. 10. John F. Rowland, Jr., the retiring president, will address the section on "Wear and Tear on Steam Boilers."

NEWS NOTES

GADSDEN, ALA.—The city officials and the street car company are at loggerheads. The Council recently passed an ordinance regulating the speed of cars and requiring the cars to be equipped with fenders, the provisions of which the company claims are unjust. Traffic was temporarily suspended, and the company threatens to remove the street car line to Anniston and also several large manufacturing interests in which the owners of the street car line are interested.

PUEBLO, COL.—The Pueblo Traction & Lighting Company has just been incorporated, with a capital stock of $1,500,000. The incorporators of the company are: W. Rice, J. F. Vail, C. E. Gast, T. N. Devine and M. D. Thatcher, of Pueblo. Several of the officers of the Pueblo Traction & Electric Company are included in the list of the incorporators of the Pueblo Traction & Lighting Company, and the latter company is presumably organized as the successor of the Pueblo Traction & Electric Company.

DENVER, COL.—In the issue of the Street Railway Journal of Nov. 17 it was reported that the Automatic Railway Switch Company, of this city, was expecting to build a factory for the manufacture of its device. Inasmuch as the apparatus is so simple that it can be easily and cheaply constructed by the various railway companies which may adopt it, this step has never been contemplated by the company, and this erroneous statement is now corrected. Practical tests of the system have been made on the Denver Railway with uniformly satisfactory results.

WASHINGTON, D. C.—A bill has been introduced in the House authorizing the Batimore & Washington Transit Company to extend its lines in the District over a specified route. The bill also provides that the Baltimore & Washington Transit Company and the Brightwood Railway Company be permitted to enter an agreement for operating cars over each others' tracks.

CHICAGO, ILL.—The traffic returns of the Metropolitan Elevated Railroad Company for November have been made public. Below is given a table showing the total number of passengers carried monthly during 1900; comparisons are made with 1899 and the increase given:

	1899	1900	Increase
January	2,242,490	2,756,135	513,645
February	2,109,632	2,593,304	483,672
March	2,456,533	2,929,748	473,215
April	2,323,920	2,712,900	388,980
May	2,352,590	2,674,928	322,338
June	2,172,990	2,466,180	293,190
July	2,093,338	2,287,490	194,152
August	2,110,170	2,432,107	321,997
September	2,285,520	2,460,000	174,480
October	2,927,330	2,690,367	*236,963
November	2,664,600	2,694,660	30,060

* Decrease.

CHICAGO, ILL.—The traffic returns of the South Side Elevated Railroad for November have been made public. Below is given a table showing the total number of passengers carried monthly during 1900; comparisons are made with 1899 and the increase given:

	1899	1900	Increase
January	1,821,609	2,154,624	333,015
February	1,688,176	1,961,400	273,224
March	1,981,179	2,240,184	259,005
April	1,916,340	2,149,950	233,610
May	1,847,228	2,117,176	269,948
June	1,683,510	2,036,760	353,250
July	1,631,964	1,890,132	258,168
August	1,630,569	1,908,267	277,690
September	1,787,539	1,951,860	164,321
October	2,287,583	2,133,575	*154,008
November	2,099,160	2,161,710	62,550

* Decrease.

GREENVILLE, IND.—The Indiana Railroad Company has been incorporated, with a capital stock of $100,000, to build two interurban electric lines. One will extend from Greenfield to Knightstown, a distance of 14 miles, and the other from Greenfield to Pendleton, a distance of 16 miles. The new road will connect at Pendleton with the line from Anderson to Greenfield, and it will connect at Knightstown with the proposed lines from Knightstown to Shelbyville. The directors of the company are: F. G. Banker, M. C. Binford, C. M. Kirkpatrick, E. J. Binford, W. C. Dudding, L. E. McDonald and W. R. McGowan, of Greenfield.

GOSHEN, IND.—J. J. Burns, of Chicago, who formerly owned the city electric lines in Goshen and Elkhart, and projected the connecting interurban line now in operation, has signed his acceptance to the franchise recently granted him by the City Council for an electric line from Goshen to Lake Wawasee.

INDIANAPOLIS, IND.—Two cars of the Indianapolis & Greenfield Electric Railway collided Dec. 21. Fourteen passengers and the motorman of one of the cars were more or less injured. The cars were badly damaged.

INDIANAPOLIS, IND.—Two cars on the Greenfield & Indianapolis line collided head-on Dec. 19, near Gem, Ind. The motormen of both cars were fatally injured and six passengers were badly hurt.

NEW CASTLE, IND.—A. D. Ogburn and others, of New Castle, have been granted a fifty-year franchise for an electric railway system in this city.

DES MOINES, IA.—The City Council has voted to accept the proposition of the Des Moines City Railway Company by which the company's taxes are to be reduced by 30 per cent for the years 1897 and 1898, and the company is to sell six tickets for 25 cents. The contract has been signed and will take effect as soon as the necessary steps are taken to take the controversy over taxes out of the courts, where they have been since 1898. The remaining back taxes of the company are to be paid in full by March 1, 1901. This includes only the general taxes, and not the special paving assessments, under the law, by which the company is still indebted to certificate holders for a large amount.

ASHLAND, KY.—Two cars filled with passengers collided near the heart of the city at 8 a. m. Dec. 19, during a heavy fog. Eleven persons were injured, and both cars were almost totally wrecked.

KITTERY, MAINE.—The Kittery, Eliot & South Berwick Street Railway Company is to be incorporated, with a capital stock of $65,000. The company proposes to construct an electric railway to connect Kittery, Eliot and South Berwick. Among those interested in the new line are: Wallace D. Lowell, president of the Union Electric Railway Company, of Dover, N. H.; Francis Keefe, of Eliot; Herbert B. Dow, of Portsmouth; William J. Kelley, of Kittery.

WESTFORD, MASS.—The Selectmen have granted the Stony Brook Street Railway Company a franchise here. The company proposes to build a line from North Chelmsford to Ayer. Col. H. B. Parker, of Newtonville, is prime mover in the new company.

NEW BEDFORD, MASS.—The Selectmen have granted the New Bedford & Onset Street Railway Company a franchise for the construction of electric lines on the Mattapoisett and Wareham roads.

FALL RIVER, MASS.—The Globe Street Railway Company has petitioned the Legislature for the right to construct an extension in Swansea, Berkeley, and Freetown, and for the right to lease the Newport Street Railway Company, of Newport, R. I., for ninety-nine years.

CONCORD, MASS.—The Concord & Boston Street Railway Company, which originally intended having a track from Concord to Waverley, passing through Lexington, has changed its plans, and now intends to construct a line through Waltham, entering that city from Lincoln. At Waverley the Concord & Boston Railway will connect with the Boston Elevated system. By passing through Waltham, instead of Lexington, the route between Concord and Waverley will be 5 miles shorter. The company has petitioned the Aldermen of Waltham for a franchise to pass over Trapelo Road, from Woburn Street to the Belmont town line.

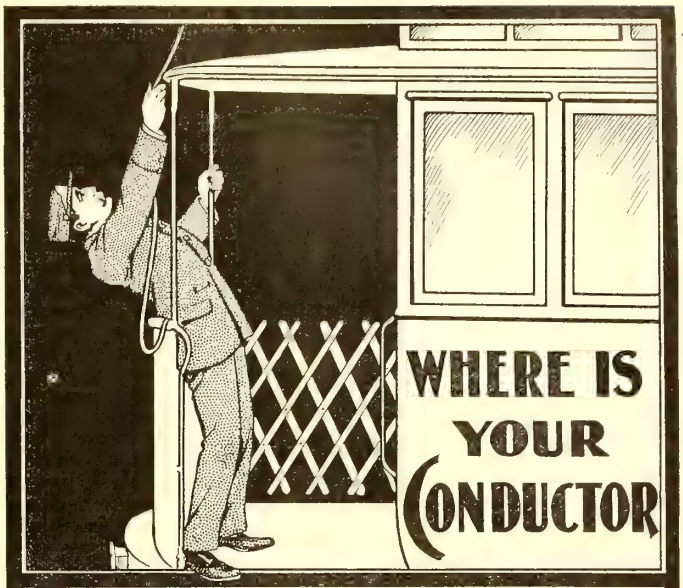
ANOKA, MINN.—The St. Francis Electric Railway Company has just been incorporated to construct an electric railway from St. Francis, a distance of 6 miles. The incorporators of the company are: C. T. Woodbury, J. S. Woodbury, of Anoka; G. D. Woodbury, of Walliston, Mass.; William Streetly and S. Hamblen, of St. Francis.

PONTIAC, MICH.—The Pontiac & Flint Electric Railway Company has completed its organization and filed articles of association with the Secretary of State. The object of the corporation is the construction of an electric railway from Pontiac to Flint, the distance on a direct line being 32 miles. The new road will connect with the Saginaw Suburban Electric Railway, now being constructed from West Bay City and Saginaw to Flint. The company will begin the work of securing the right of way at once, and the line will be constructed early in the spring, the idea being to have a continuous line in operation between Bay City, West Bay City and Saginaw to Pontiac via Flint before next fall. Among those interested in the company are: William Stoddard, of Minneapolis; G. V. Chandler, W. F. Stevens, W. G. Emerick and George Silsley, of Saginaw.

NEWARK, N. J.—The State Board of Taxation has rendered a decision reducing from $3,100,000 to $2,266,000 the assessment made against the North Jersey Street Railway Company by the city of Newark. The assessment included about $500,000 representing franchise value. This the State Board held could not be taxed. A further reduction was allowed because of the liability of the company's rolling stock and equipment to wear and tear.

BROOKLYN, N. Y.—A Grand Street car of the Brooklyn Rapid Transit Company collided with a car of the Metropolitan Avenue line of same company at the terminus of the two lines at the foot of Broadway on Dec. 24. Both cars were badly damaged as a result of the collision, and one person was killed and several injured.

BROOKLYN, N. Y.—The new through train service over the Bridge and the Fifth Avenue line of the Brooklyn Elevated Railroad was begun Dec. 18



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On long runs, on fast cars, is it not true that they spend most of their time on the back platform swinging the trolley on to the wire?

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by the Brooklyn Rapid Transit Company. The through trains will be operated during the hours between 10 a. m. and 4 p. m. and from 4 p. m. to 5 a. m. The trains are to be run between Park Row and Bath Beach. All of the cars used in this service have been equipped so that they may be operated by the third-rail system while on the elevated road and by the trolley arrangement when they travel on the surface.

WHITEHALL, N. Y.—Plans are being matured for the construction of the Whitehall & Granville Railroad. The company was incorporated Sept. 11, 1900, with a capital stock of $750,000, and proposes to construct an electric railway from Whitehall through East Whitehall, Truthville, Middle Granville and Granville, and then to West Paulet, Vt., a distance of 20 miles. The district through which the road will pass is well populated, and rich deposits of slate are found in abundance. The company proposes to tap this slate region and thus secure an immense freight business. At present steam connections are poor, and much carting has to be done in order to make shipments. Many men are now employed at the mines, who will use the new road as a means of travel, and it is estimated that many new mines will be worked on the completion of the new road, because of increased facilities. The lack of facilities has always been a serious drawback to development in the vicinity. The company has secured water power privileges. The power station will be located about ⅛ mile from the main line of the road at a point about equal distance from the terminals of the road, and a side track will connect it with the main line. A company is to be organized under the laws of Vermont to operate a line from Poultney, Vt., along the west side of Lake St. Catherine, admirably suited for park purposes, to Granville. This company will operate in harmony with the New York company. The estimated cost of constructing this road is placed at $350,000. The officers of the Whitehall & Granville Railroad Company are: Emmet J. Gray, of Whitehall, president; E. R. Norton, of Granville, vice-president; Charles I. Baker, of Troy, secretary; Daniel B. Woodward, of Granville, treasurer; Charles B. Story, of Hoosick Falls, general superintendent.

EAST LIVERPOOL, OHIO.—The Salem, Lisbon & East Liverpool Electric Railway Company will be incorporated within a few days, with a capital stock of $500,000. The company contemplates building an electric railway from Salem to Lisbon and East Liverpool. Franchises and rights of way have been secured. Eastern capitalists are financing the project.

YOUNGSTOWN, OHIO.—The Youngstown & Sharon Electric Railway Company has applied to the City Council for a franchise to enable its road to reach the center of the city. The road is partially completed, but this is the first time an application has been made to the city for a franchise.

BRYAN, OHIO.—The Northern Ohio Electric Railway Company has been organized to build an electric railway from Bryan to Defiance. The towns are only 16 miles apart, but at present it requires over 100 miles of railway travel to go from one point to the other. Elias Bartholomew, of Toledo, is president of the company; W. B. Sherwood, vice-president and general manager; H. C. Warren, secretary and treasurer. Franchises have been secured.

MEDINA, OHIO.—The Council has canceled franchises granted some time ago to the Ceveland, Medina & Southern Railway and the Cleveland, Elyria & Western Railway, and has granted new franchises, imposing severe terms. Both roads must use the same tracks into town, and tracks must be laid by June 1, 1901, otherwise the grants will be withdrawn. The Cleveland, Medina & Southern Railway will be extended beyond Medina to Chippewa Lake, Seville and Wooster.

UPPER SANDUSKY, OHIO.—T. Olliver, of New York, is at work in the county securing right of way for a through line from Columbus to Toledo. The road would be almost an air line 150 miles in length, passing through Delaware, Marion, Upper Sandusky, Fostoria, and a number of other large towns. The promoter says the third-rail system will be used and from three to five cars in a train.

CLEVELAND, OHIO.—The Cleveland City Railway Company has leased Scenic Park, at the end of its Detroit Street line. It will be greatly improved, and will be operated as a place of amusement.

COLUMBUS, OHIO.—The Norwalk, Ashland & Southern Railroad Company has been incorporated by C. P. Wickham, G. T. Thomas, F. C. Jackson, J. R. McKnight and C. C. Curtis. It is the intention of the company to construct an electric railway from Norwalk to Ashland, passing through Olena, Fitchville, New London, Savanna and Savanna Lake, all isolated towns. The temporary capital stock of the company is $10,000.

COLUMBUS, OHIO.—The Mansfield, Mt. Gilead & Columbus Electric Railway, Light & Power Company has been incorporated by T. Y. McCay, F. J. Boals, Thomas E. Barrow, Lewis J. McCay and T. Y. McCay, Jr. The purpose of the company is to build a system of roads in Richland, Crawford, Morrow, Delaware and Franklin counties. The main line is to extend from Mansfield to Columbus, with branches to Ashland, Savanna, Marion and Mt. Gilead. The capital stock of the company is $20,000.

IRONTON, OHIO.—It is announced that the title of the Ohio Valley Electric Company, which controls the Ironton Electric Railway & Light Company, Ashland & Catlettsburg Street Railway Company, of Ashland, Ky., and the Consolidated Light & Railway Company, of Huntington, W. Va., will be changed early in January to the Camden Interstate Railway Company.

NORWALK, OHIO.—This city gives promise of becoming one of the greatest electric railway centers in the State. The Sandusky, Milan & Norwalk Railway is in operation; the Toledo, Fremont & Norwalk Railway; the Sandusky, Bellevue, Monroeville & Norwalk Railway are being built, and the latter proposes to build an extension south to Shelby; the Cleveland Elyria & Western Railway and the Sandusky & Interurban Railway, both propose to extend to this place, the former from Oberlin, and the latter from Ceylon, and within the past few days the Norwalk, New London & Ashland Company has been organized to build between these points.

OKLAHOMA CITY, OKLA.—The Oklahoma Light, Power, Fuel & Gas Company has just been incorporated, with a capital stock of $300,000. The company proposes to build 20 miles of electric road in Oklahoma City

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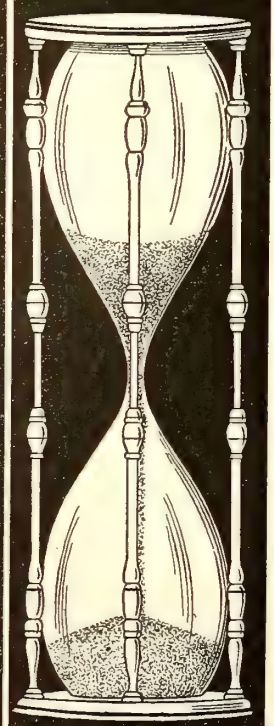

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and to operate an electric plant for furnishing light, heat and power. The directors of the company are: Norman W. Gifford, of Chicago; Roscoe D. Farmer, of Benton Harbor, Mich.; A. C. Root, T. F. McMeacham and A. R. Hayes, of Oklahoma City.

WILKINSBURG, PA.—The Monongahela Street Railway Company has been granted an extension of one month's time in which to complete its Franklin Street line.

SPRINGFIELD, PA.—The franchise of the Springfield Street Railway Company, which three years ago obtained a right of way from Darby, through Springfield, Marple and Upper Providence townships and other points, has been purchased at receiver's sale by Simon Bennet, of Springfield. It is stated that the company will be at once reorganized to build the road.

PROVIDENCE, R. I.—The Council has passed an ordinance restricting the size and weight of electric cars to be operated on the city streets. The ordinance is directed chiefly against the New York, New Haven & Hartford Railroad, and provides that no passenger car shall be propelled through the streets the maximum length of which shall exceed 42 ft. over all, the maximum width of which shall exceed 9 ft., the maximum weight of which shall exceed 42,000 lbs. when empty, and in no event to exceed 60,000 lbs. when loaded.

GALVESTON, TEX.—The Galveston City Street Railway Company has just been incorporated by W. G. Oakman, George R. Turnbull, Edward Connell, of New York; R. B. Baer, of Houston, and J. W. Terry, of Galveston, as successor of the Galveston City Railroad Company. The capital stock of the company is $800,000.

CANADIAN NOTES

HAMILTON, ONT.—The Hamilton, Grimsby & Beamsville Railway Company has asked permission from the county to extend its lines from Beamsville to St. Catherines.

WINDSOR, ONT.—William Simpson has secured right of way for the construction of an electric railway from Essex to Wheatley.

LINDSAY, ONT.—Bemont & Ritchie, solicitors, of this city, will make appplication to the government to amend the act respecting the Dawson City Electric Company and to extend the time for the construction of the railway.

AYLER, QUEBEC.—The Hull Electric Company is now making an effort to secure entrance to Ottawa. If the company is successful it will build a depot and waiting room in Ottawa.

MONTREAL, QUEBEC.—Since the supply of power from Chambly has been cut off the Montreal Street Railway Company has been depending on its own plant for power. The capacity of the latter plant is limited. An accident occurred to one of the engines a few days ago, and the company was obliged to withdraw one hundred cars from service.

CONSTRUCTION NOTES

JACKSONVILLE, FLA.—The Jacksonville Street Railway Company is planning to make important improvements to its property. The Riverside, Main Street and La Villa lines of the company are to be extended and new cars are to be added to the equipment.

FLOVILLA, GA.—W. F. Smith, of Flovilla, general manager of the Flovilla & Indian Spring Railroad, announces that arrangements are now being perfected for the construction of the new electric railway between Flovilla and Indian Springs. It is expected that the road will be ready for operation early in the spring.

INDIANAPOLIS, IND.—It is announced that the Indianapolis Street Railway Company has decided to install an electric fountain in each of the parks touched by the company's lines. The electric fountain is said to have proved a great traffic inducer.

GREENWOOD, IND.—The Indianapolis & Greenwood Traction Company has put a large force of men at work grading the road from Greenwood to Franklin. The line will be extended and in operation by June 1, 1901.

FORT WAYNE, IND.—The official title of the new electric railway to be built by Townsend, Reed & Company from the center of Fort Wayne to the center of Huntington, and which was noted in the STREET RAILWAY JOURNAL for Dec. 22, is the Fort Wayne & Southwestern Traction Company. The company is now negotiating for the purchase of twenty acres of land just outside of the city limits, and it is the intention of the company to spend $50,000 in fitting up the park and have it ready when the road is completed, June 1, 1901. The company now has a force of thirty men and eight teams at work grading and putting in culverts. The road will be constructed on standard steam railroad lines, and the grade will not exceed 1 per cent at any point. The company has under contemplation the building of a central power plant at Fort Wayne, which is designed not only to furnish power for the road, but for manufacturing and other enterprises in Fort Wayne, Roanoke and Huntington. The car houses will be located at Fort Wayne and Huntington. The company has awarded the Ohio Brass Company, of Mansfield, Ohio, the contract for the overhead material, and the contract for twelve cars has been placed with the Jewett Car Company, of Newark, Ohio. The latter will be equipped with four 50-hp Johnston steel motors, geared to 51 miles an hour.

DES MOINES, IA.—The Des Moines Street Railway Company has commenced the construction of several large cars at its shops in this city. They are to be completed within sixty days. The company will also construct the cars for its Army Post and Indianola lines.

PALMER, MASS.—The Palmer & Morrison Street Railway Company expects to build a new line between Palmer and Ludlow, a distance of 9 miles.

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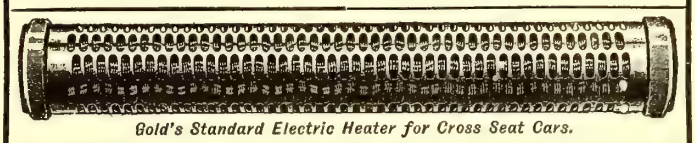

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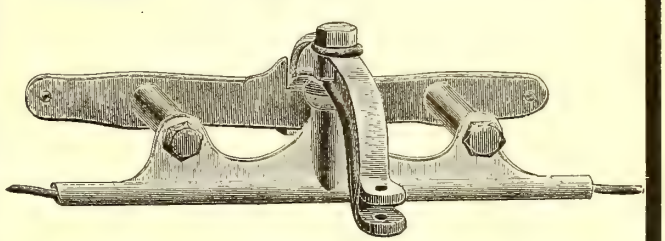

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The company will build a new car house (130 ft. x 60 ft.), boiler, engine and dynamo room, and has purchased a 500-hp cross-compound engine, 400-kw railway generator and 250-hp water-tube boiler.

DE SOTO, MO.—Work has been started on the new electric railway to extend from De Soto to Victoria. The road will eventually be extended to Hillsboro, Riverside, Sulphur Springs and Jefferson Barracks.

KANSAS CITY, MO.—The Kansas City & St. Joseph Electric Railroad Company has just been incorporated, with a capital stock of $1,500,000, to construct an electric railway north from Kansas City to Parkville, Platte County, to Platte City, Dearborn, Faucet and St. Joseph. The road will be built almost entirely over a private right of way, and active engineering work is to be begun in a short time. There will be but one or two bridges and practically no trestling. The three-phase system will be employed, and 70-lb. or 75-lb. T-rail and 90-lb. girder rail will be used. No contracts have been awarded for construction. The officers of the company are: P. A. Gibson, of Erie, Pa., president; Charles E. Gibson, of Kansas City, vice-president; Robert P. McGeenan, of Parkville, Mo., secretary and treasurer. The address of the company is New York Life Building, Kansas City.

MANCHESTER, N. H.—The Manchester Street Railway has been granted franchises for the extension of its lines to Goffe's Falls, Jewett Street and to Derryfield Park oval.

CAMDEN, N. J.—The Borough Council of Merchantsville has granted the Camden & Suburban Railway Company a franchise for the construction of an electric railway through the borough. The company has been trying for several years past to secure the franchise just granted. It now has a line under construction to Moorestown. The line will be constructed at once.

UTICA, N. Y.—The Utica Suburban Railway Company has completed and placed its extension to Capron in operation.

NEW YORK, N. Y.—The Union Electric Railway Company is now constructing an extension of its lines through Bronxville.

SYRACUSE, N. Y.—For the further extension of the service, the Syracuse Rapid Transit Railway Company is considering the purchase of several large 40-ft. double-truck closed cars for the Salina Street line. The company is also considering the extension of its Green Street line along Lodi Street, Highland Avenue and Oak Street.

GERMANTOWN, OHIO.—The Miamisburg & Germantown Traction Company has contracted with the Southern Ohio Traction Company for furnishing power to operate its new lines.

YOUNGSTOWN, OHIO.—The Youngstown & Sharon Electric Railway Company has awarded the Babcock & Wilcox Company a contract for new boilers of 2000 hp.

COLUMBUS, OHIO.—The Columbus, London & Springfield Railway Company has awarded contracts for the construction and equipment of its road, and expects to have the road completed by June, 1901. The road will extend from Columbus to Springfield, a distance of 45 miles. The power house and car houses will be located at Columbus and London.

CLEVELAND, OHIO.—The Western Ohio Railway Company, which is building an electric railway from Lima to St. Mary's, has closed a contract for the erection of its power house at St. Mary's. A contract has also been closed with the Sterling Boiler Company for a 1500-hp battery of boilers. Contracts for engines and generators have not yet been closed.

CLEVELAND, OHIO.—The Cleveland & Chagrin Falls Electric Railway Company has closed a contract with Sipe & Sigler, of Cleveland, for the installation of a storage battery plant in its new station 3 miles east of Cleveland. The company's power house is at the end of the road at Chagrin Falls. The first installation will give 400 amp.-hours, and the plant is to be so arranged that this can be increased by one-half without change. When the new plant is placed in operation it is expected that the running time from Chagrin Falls to the city limits at Cleveland, 14 miles, will be reduced to thirty minutes or one hour to the center of the city. The company is in the market for four modern passenger coaches.

CINCINNATI, OHIO.—The Mill Creek Valley Street Railway Company is to place its new extension from Carthage to Glendale, a distance of 5 miles, in operation Jan. 1, 1901. The company's new power house at Hartwell is nearly completed. It is a brick and stone structure and is equipped with a Westinghouse 400-kw generator, direct-connected to a Buckeye compound tandem engine; two G. E. 500-kw units each, direct-connected to compound tandem McIntosh & Seymour engines. There are four 300-hp boilers of the B. W. type. The rolling stock consists of sixteen single-truck cars, equipped with Peckham trucks and G. E. motors; the overhead material was all furnished by the Ohio Brass Company. B. L. Baldwin & Company are the engineers and contractors for the power house and generating plant. Guy M. Gest is the engineer and contractor for the track construction.

HARRISBURG, PA.—The Rockville extension of the Harrisburg Traction Company's lines was opened for travel its entire length Dec. 23. The line was opened for travel as far as Lucknow Dec. 15.

LANCASTER, PA.—The Lancaster Traction Company opened its new line to Mechanicsburg Dec. 23. The new power plant will not be ready for operation, however, for about a week.

CARNEGIE, PA.—Preliminary arrangements have been made for the building of the Carnegie, McDonald & Canonsburg Electric Railway. It is expected that the line from McDonald to Oakdale will be completed by July 1. The line will extend from Canonsburg to Woodville, and will go through McDonald, Beechmont, Hickman, Federal and Rosevale. The officers of the company are: Edward McDonald, president; J. W. Nesbit, vice-president, and R. J. Stoney, Jr., secretary and treasurer.

FORT WORTH, TEX.—F. M. Haines, general manager of the Fort Worth Street Car Company, states that bids will be opened and the contract probably let for the construction of the interurban electric railway to connect Fort Worth and Dallas Jan. 1. Mr. Haines states that the company will be ready to commence construction early in January.

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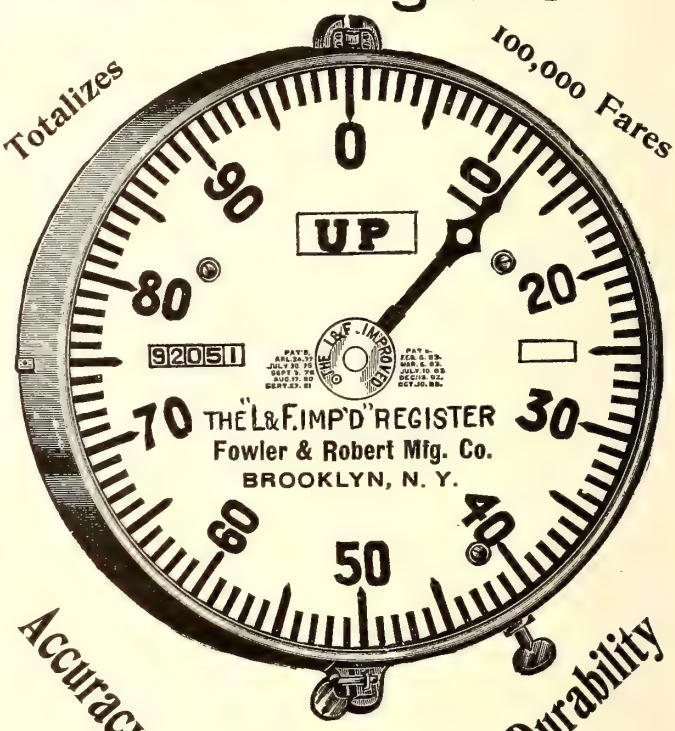

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CANADIAN NOTES

HAMILTON, ONT.—John Patterson, of the Cataract Power Company, has announced that the construction of the Hamilton, Guelph & Gault Electric Railway has been abandoned, owing to the opposition of the residents of Hamilton to the construction of the road.

SARNIA, ONT.—The Sarnia Street Railway Company is now closing contracts for the reconstruction and electrification of its lines. The company has awarded the Ottawa Car Company, of Ottawa, the contract for the car bodies; the Taylor Truck Company, of Troy, N. Y., has been awarded the contract for the car trucks; the Ohio Brass Company, of Mansfield, Ohio, has been awarded the contract for the line material.

THE MARKETS

The Money Market

NEW YORK, December 26, 1900.

Although the range of the rate on call money has been from 3½ per cent to 6½ per cent during the past week, the price has been firm at practically 5 per cent, and still remains at this figure. Large sums of money will, of course, at the opening of the year, be freed and put in distribution, but the immense amount of trading which is taking place in the various markets throughout the country will probably have the effect of keeping the supply and demand evenly balanced. The bank statement for the week ending Dec. 22 indicates smaller gains in average cash then had been expected from the market movements. The surplus reserve shown is $9,497,000, an increase of $3,171,625 over the preceding week. The price for call money in various cities is as follows: Boston, 4½ per cent to 6 per cent; Chicago and Baltimore, 4½ per cent to 5 per cent; Philadelphia, 4 per cent; London, 3¼ per cent to 3½ per cent; Paris, 3 per cent; Berlin and Hamburg, 5 per cent; Amsterdam, 3½ per cent. Time money is still offered in New York with moderate liberality, and the rates have not materially changed, being 5 per cent for thirty days, 4¼ per cent for sixty days, and 4½ per cent to 5 per cent for four to six months.

The Stock Market

A continually ascending market was interrupted by the holiday season. The general increase in industrial and railway stocks was led by American Sugar Refining and General Electric in the former, and by Brooklyn Rapid Transit in the latter. The trading has been excessively active, breaking all records for this season. The combinations of large transportation and industrial interests, both assured and speculative, has been largely responsible for the prominence of the bull element among the brokers, and that its control will probably continue is shown by the care which is being taken by financial leaders to cover their shorts. The end of the century is therefore marked by a marvelously extended example of prosperity, caused by a sound financial policy of the government and general confidence in the business world, while all the indications point to a continuation of these excellent conditions into the century about to dawn. Last week's stock transactions amounted to 7,959,427 shares, against 5,204,400 shares for the corresponding week of last year. The transfers of bonds for last week, however, amounted to $27,129,200, while for the same week in 1899 it was only $15,981,350.

The usual quotations of stocks of the leading railways, industrials and tractions follow:

STREET RAILWAYS

	1900 Year to Date High	Low	Closing Bid Dec. 17	Dec. 22
American Railways Co.	37	27	33	34
Boston Elevated	158	b95	156	157½
Brooklyn R. T.	84⅜	47⅛	77⅞	83¾
Buffalo Ry.	..	..	100	100
Chicago City	285	240	255	253
Chicago Union Tr. (common)	..	..	10	11¼
Chicago Union Tr. (preferred)	..	..	44	44½
Citizens' Pass. (Indianapolis)	..	..	15	15
Cleveland City	..	..	102	103
Cleveland Electric	..	..	83	83
Columbus (common)	32½	20	32½	32½
Columbus (preferred)	..	..	89	91
Lake Street Elevated	11¼	6½	10	10
Louisville	..	..	82	82
Manhattan Ry.	114½	84	113	113¼
Massachusetts Elec. Cos. (common)	29	15	26	26¼
Massachusetts Elec. Cos. (preferred)	80¾	70	79¾	79
Metropolitan Elevated, Chicago (common)	37½	24½	31⅜	30
Metropolitan Elevated, Chicago (preferred)	85	76	83	83¼
Metropolitan Street	182	143¾	173½	174
New Orleans (common)	29½	18¼	22	22
New Orleans (preferred)	..	..	94	94
North American	21	13⅝	19¼	19¼
North Jersey	31	21	24½	24½
Northwestern Elevated, Chicago (common)	..	..	29½	29
Northwestern Elevated, Chicago (preferred)	..	..	79½	a79½
Rochester	..	..	22	22
St. Louis Transit Co. (common)	..	..	20¾	18¼
St. Louis Transit Co. (preferred)	..	..	69	66
South Side Elevated (Chicago)	102½	93	99	98½
Syracuse (common)	15	11	11	11
Syracuse (preferred)	..	..	a40	a37
Third Ave.	135⅛	45¼	118	117
Twin City, Minneapolis (common)	68½	58½	70	..

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	1900 Year to Date High	Low	Closing Bid Dec. 17	Dec. 22
Twin City, Minneapolis (preferred)	146	136	..	..
Union Traction (Philadelphia)	40⅛	28½	36⅛	..
United Traction (Providence)	110	107	109	109
Worcester Traction (common)	34½	25	34½	34½
Worcester Traction (preferred)	..	..	107	107

INDUSTRIALS

	1900 Year to Date High	Low	Closing Bid Dec. 17	Dec. 22
American Steel & Wire	59⅞	28½	c42⅞	44½
Cambria Steel ($4.50 paid)	22½	13¾	20¼	20
Federal Steel	57¾	28¾	53	55¼
General Electric	199	120	171¾	195
National Steel	53½	20	38½	40¾
National Tube	64½	40⅞	62	63¼
Republic Iron & Steel	27½	8¾	16	16⅞
Tennessee Coal & Iron	104	49	61⅝	64⅜
United States Rubber	44	21	28	28¼
Westinghouse E. & M.	55¾	40	55	55¾

RAILROADS

	1900 Year to Date High	Low	Closing Bid Dec. 17	Dec. 22
Baltimore & Ohio	89⅞	55¼	82	81⅜
Canadian Pacific	99¾	84¾	87¼	89⅜
Chicago, Burlington & Quincy	142⅛	119⅛	138¼	141¾
Chicago, Milwaukee & St. Paul	132	108½	132⅛	136½
C., C., C. & St. Louis	73¾	55	70½	70½
Illinois Central	132¼	110	126¾	130⅜
Louisville & Nashville	87⅜	68¾	85¼	87⅛
Missouri Pacific	70	38⅜	62⅜	69½
New York Central	145½	125⅛	142¼	145½
Northern Pacific	85½	45¾	78½	83¾
Pennsylvania	145	124⅜	143⅞	144⅝
Southern Pacific	45⅜	30⅜	42¾	44⅞
Southern Railway	23¼	10⅝	19¾	22¼
Union Pacific	78	44⅜	75½	77¼

a Asked. b Bid. c Ex-dividend.

Iron and Steel

All reports from iron and steel centers show a healthy condition of affairs and a hopeful outlook. The business is more or less steady, with good prices reigning, and in many instances orders have been received which will require months for completion. Some markets, however, show a quietness, and there is a little uncertainty as regards the outcome of certain developments which readjustment of prices and wages may produce. The Pittsburgh quotations on Bessemer pig range from $13.50 to $13.75, and on billets $19.75, delivered. The price of structural material remains the same, including the price of plates. Rumors are current, however, that both plates and beams will probably go up after the first of the year. Business is looked for also about that time from several large trunk lines for steel rails, the present quotation for standard sections being $26 per ton at the mill. For girder rails $38 is asked, but business is dull.

Metals

Pig tin and pig lead are both in good demand, although it is not particularly heavy. The domestic market for copper, however, is very dull. The nominal prices for this are firm at 16⅞c. for Lake and 16½c. for electrolytic and casting stock. In large lots, pig lead is quoted at 4.27½c., and pig tin at 25½c. to 25¾c.

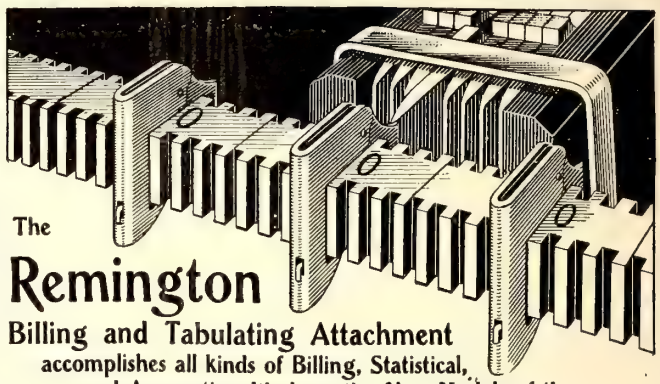
FINANCIAL NOTES

COVINGTON, KY.—The Cincinnati, Newport & Covington Railway Company reports earnings as follows:

November	1899	1900
Gross receipts	.....	.....
Operating expenses	$60,089	$63,001
Earnings from operation	23,214	28,289
Fixed charges, etc.	$36,875	$34,717
Net earnings	11,981	12,314
	$24,894	$22,403

Year to Date	1899	1900
Gross receipts	$652,364	$718,357
Operating expenses	262,417	293,678
Earnings from operation	$389,947	$424,679
Fixed charges, etc.	135,222	136,118
Net earnings	$254,725	$288,561

BOSTON, MASS.—At a special meeting of the stockholders of the Massachusetts Electric Companies held Dec. 24 it was decided to issue $2,700,000 five-year notes, in accordance with the plan noted in the Street Railway Journal for Dec. 22. The notes are to be dated Jan. 1, 1901, and will bear interest at 4½ per cent per annum, payable semi-annually. The companies will have the privilege of redeeming the notes after Jan. 1, 1902, on a 4 per cent basis. The indenture also provides for an additional issue of like



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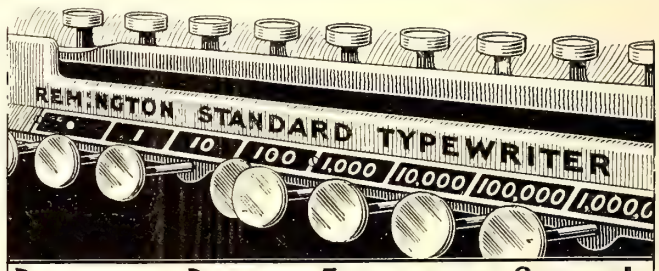

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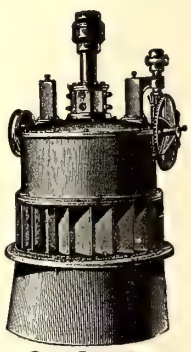

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notes, similarly secured, to the amount of $800,000, making a total of the ultimate possible issue under the vote and indenture of $3,500,000. The stock pledged as collateral to these notes is to be new shares of the Brockton Street Railway and Lynn & Boston Railroad and of other companies controlled by the Massachusetts Electric Companies, not including any of the stocks or other securities heretofore held by the trustees of the Massachusetts Electric Companies against which their own shares are issued.

BENTON HARBOR, MICH.—Granger, Farwell & Company, of Chicago, are now offering $200,000 first mortgage 5 per cent $1,000 gold bonds of the Benton Harbor & St. Joseph Electric Railway & Light Company for subscription at 103 and interest. The bonds are due Sept. 1, 1920, interest payable Sept. 1 and March 1 at the office of the American Trust & Savings Bank, of Chicago, trustee. The company is a consolidation of the St. Joseph & Benton Harbor Street Railway Company, Benton Harbor & Eastern Springs Electric Railway Company and the Benton Harbor & St. Joseph Electric Light Company.

NEW YORK, N. Y.—The regular quarterly dividend of 1¾ per cent on Metropolitan Street Railway stock is payable Jan. 15.

WATERTOWN, N. Y.—A certificate of consolidation of the Black River Traction Company and the Dexter & Brownville Street Railway Company, with a capital of $105,000, has been filed with the Secretary of State. The new company will be known as the Black River Traction Company, and the directors are: Julius A. Lebkuecher, George Krementz, Chandler W. Riker, of Newark, N. J.; Hiram F. Inglehart, George H. Walker, Thomas Burns, N. P. Wardwell, Chester F. Inglehart, S. R. Smith, of Watertown.

BUFFALO, N. Y.—Bartlett, Frazier & Company and Edwin A. Bell have issued the following circular from their Buffalo office: "At present no stock or bonds of the International Traction Company have been actually issued, but instead J. P. Morgan & Company have issued $10,000,000 International Traction certificates, or trust receipts, against the total issue of bonds, $11,428,000, and 80 per cent of the preferred stock, viz.: $4,000,000. Each certificate carries its proportionate share of bonds and preferred stock. A certificate for $10,000 carries $11,428 bonds and $4,000 preferred stock. At first the certificates bore interest on their face value of 4 per cent, but the company has paid interest on the bonds itself since July, 1900, when it paid 2.285 per cent as semi-annual interest at the rate of 4.47 per cent annually on the face value of the certificates. These certificates bare the original date of March 1, 1899, and J. P. Morgan & Company have a practical option on them until Sept. 1, 1901, under an agreement incorporated in the original circular.

CLEVELAND, OHIO.—Cleveland, Elyria & Western reports earnings as follows for November: Gross earnings, $15,813; operating expenses, $8,381; net earnings, $7,432; interest, $3,270; surplus, $4,162.

STEUBENVILLE, OHIO.—The American Gas Company, of Philadelphia, is the purchaser of the property of the Steubenville Traction Company and the Steubenville Gas & Electric Company. The announcement of this sale was previously reported, but the name of the purchaser was not disclosed at that time.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company reports earnings as follows: November: gross receipts, $174,733; operating expenses, $96,807; net earnings, $77,925; interest, $20,795; surplus, $57,139. For eleven months: gross earnings, $1,876,050; operating expenses, $1,019,600; net earnings, $856,449; interest, $239,008; surplus, $617,441.

LORAIN, OHIO.—The Lorain & Cleveland Railway Company reports earnings as follows for November: Gross receipts, $6,377; operating expenses, $3,058; earnings from operation, $3,319.

PITTSBURGH, PA.—The Consolidated Traction Company reports earnings as follows:

November	1899	1900
Gross receipts	$216,094	$235,545
Operating expenses	102,483	106,588
Earnings from operation	$113,611	$128,957
Receipts from other sources	29,365	27,995
Net earnings	$142,976	$156,952
Fixed charges, dividends, rentals, etc	135,364	149,525
Surplus	$7,612	$7,427
First eight months of fiscal year	1899	1900
Gross receipts	$1,759,098	$1,968,391
Operating expenses	856,779	904,171
Earnings from operation	$902,319	$1,064,220
Receipts from other sources	223,503	225,866
Net earnings	$1,125,822	$1,290,086
Fixed charges, dividends, rentals, etc	1,082,675	1,189,897
Surplus	$43,147	$100,189

PORTLAND, OREGON.—The Waverley-Woodstock Electric Railway Company has called for redemption and proposes to pay, Jan. 1, 1901, at the office of the Security Savings & Trust Company, of Portland, bonds numbered respectively 92, 93, 94, 104, 105, 106, 107, 108, 109 and 110, secured by the mortgage issued in April, 1891, by the Security Savings & Trust Company, such redemption to be made by paying $1,040, together with interest accrued on the same and unpaid at the time so fixed for redemption, for each of said bonds so called; interest upon said called bonds will cease at the date so fixed for their redemption.

TORONTO, ONT.—The Toronto Street Railway Company has declared the regular quarterly dividend of 1 per cent for the quarter just ended, payable Jan. 2, 1901.

OTTAWA, ONT.—The Ottawa Electric Railway Company has decided to increase its capital stock from $781,000 to $1,000,000, and to increase its bonded indebtedness from $320,000 to $500,000. These increases are made to cancel some outstanding bonds and for the losses sustained in the recent fire.

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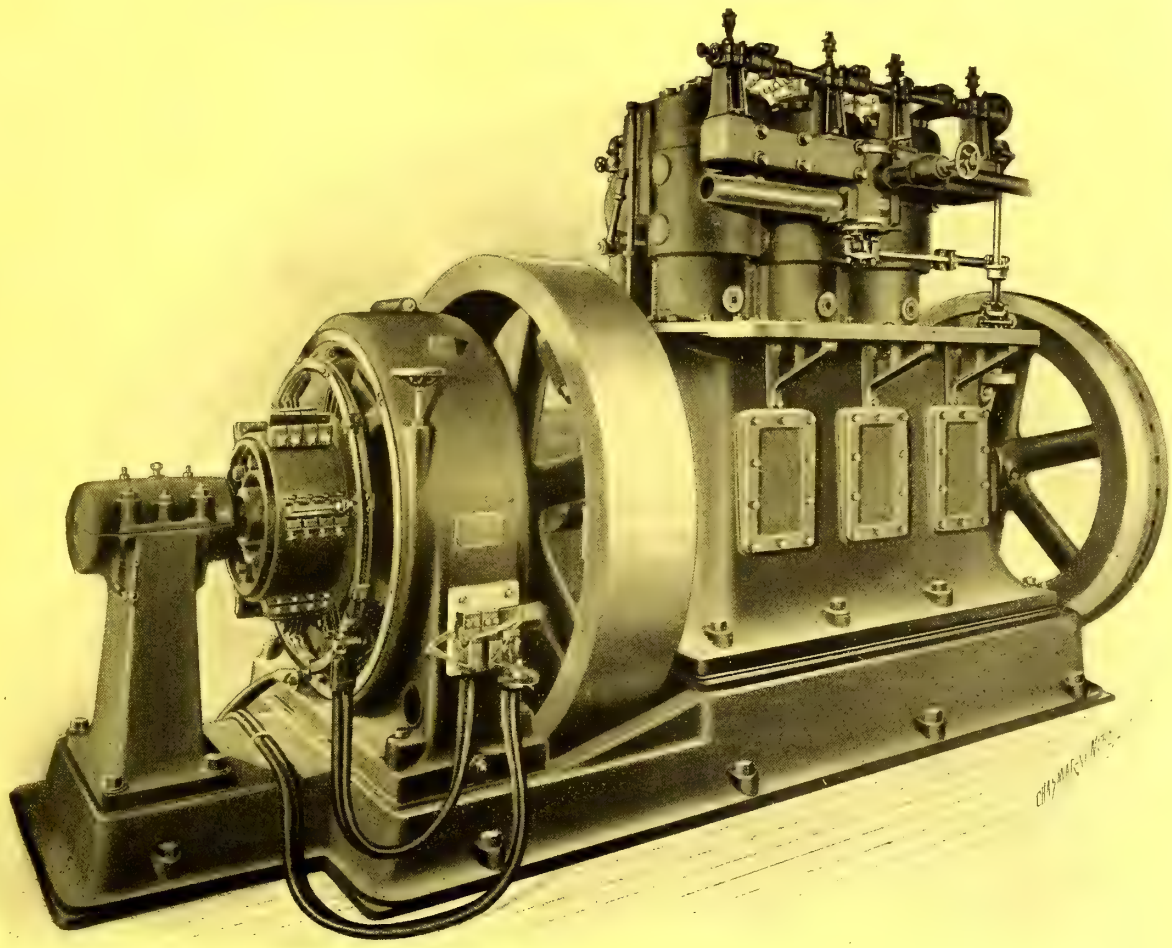

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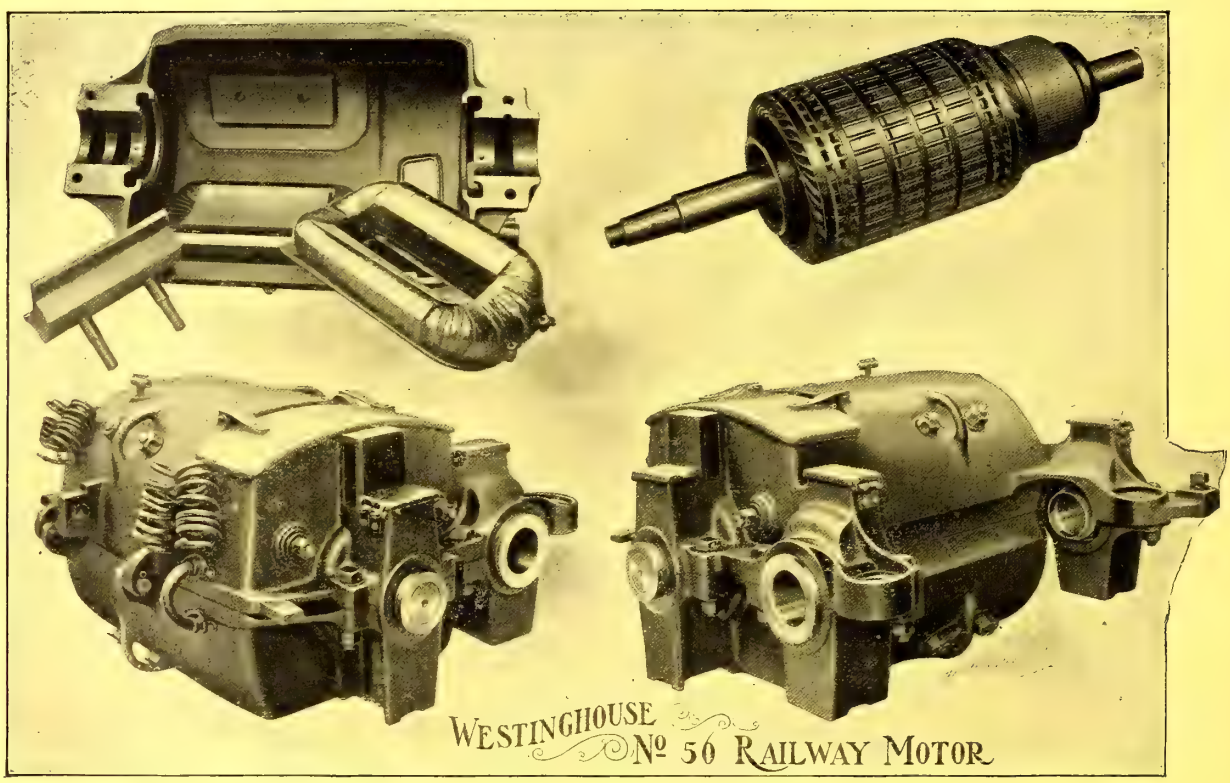

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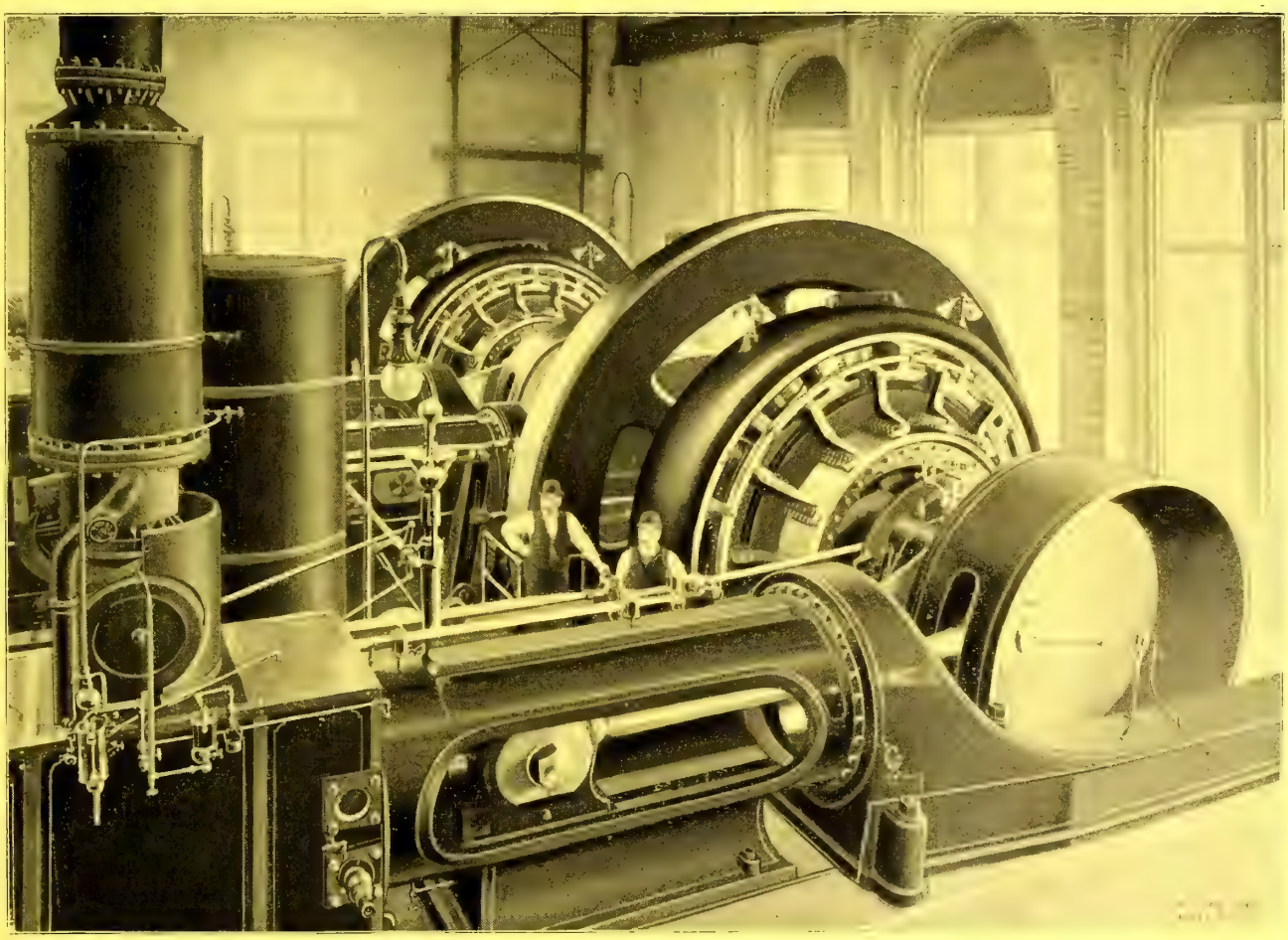

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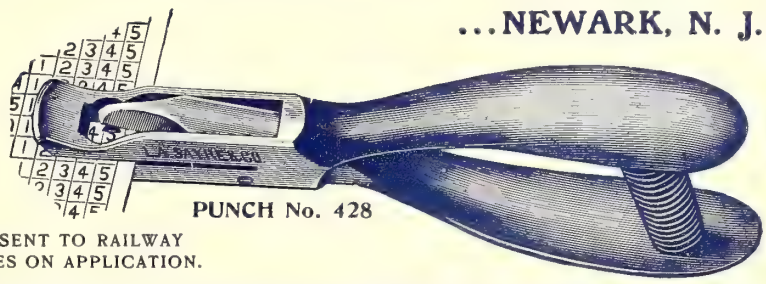

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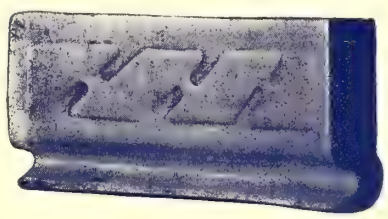

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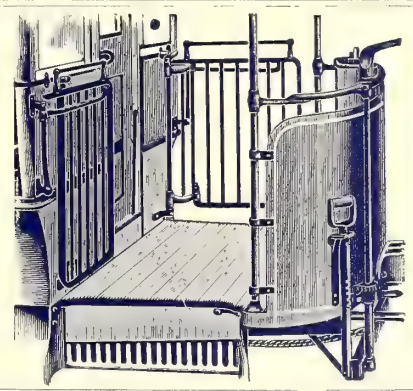

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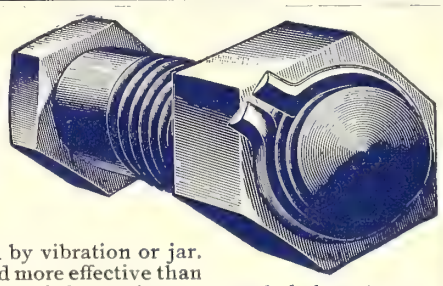

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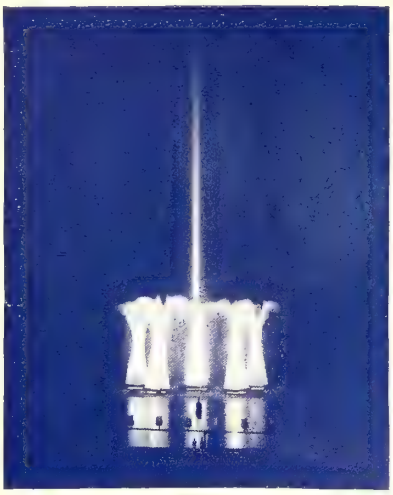

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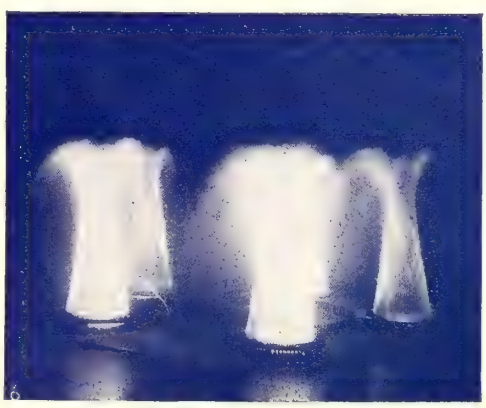

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Of these manufacturers about 2½% have in use accounting systems which are adequate and satisfactory.

Not to exceed 10% have in use accounting methods that they imagine are up to date and which they affect to believe are the very best that can be obtained, but which, nevertheless, could be improved.

About 25% are employing accounting plans which they have the boldness to assert are satisfactory. At the same time, when off their guard, they betray uneasiness and anxiety with respect to various details.

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October, Nineteen Hundred

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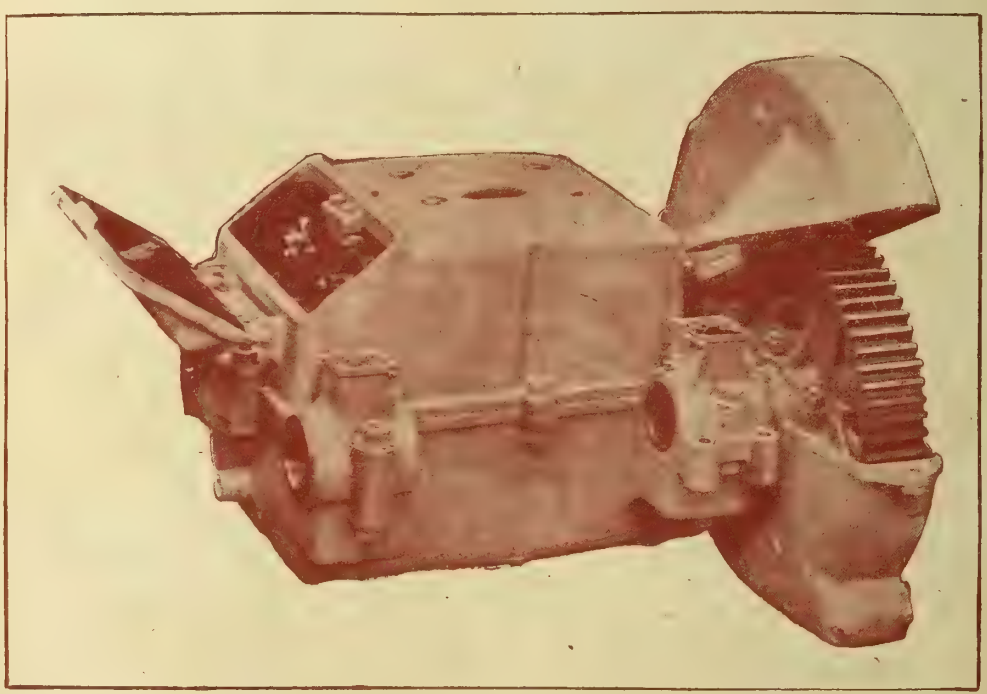

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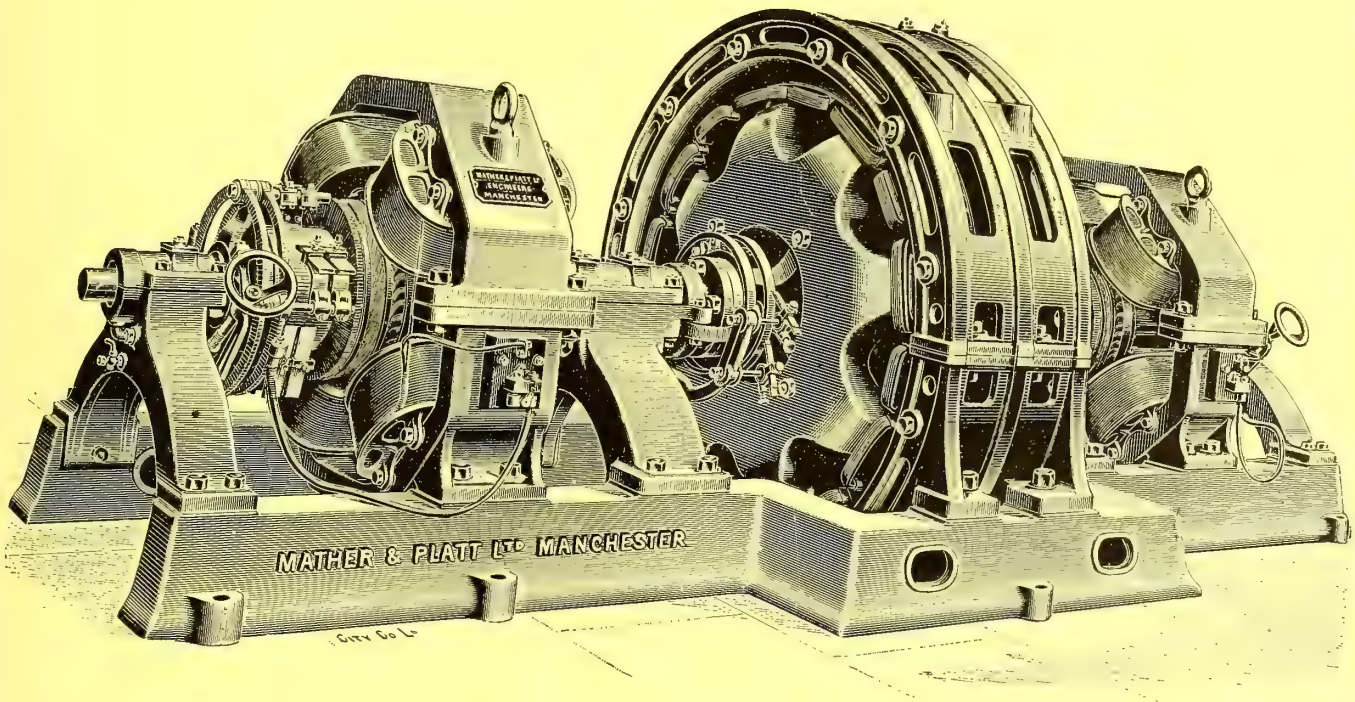

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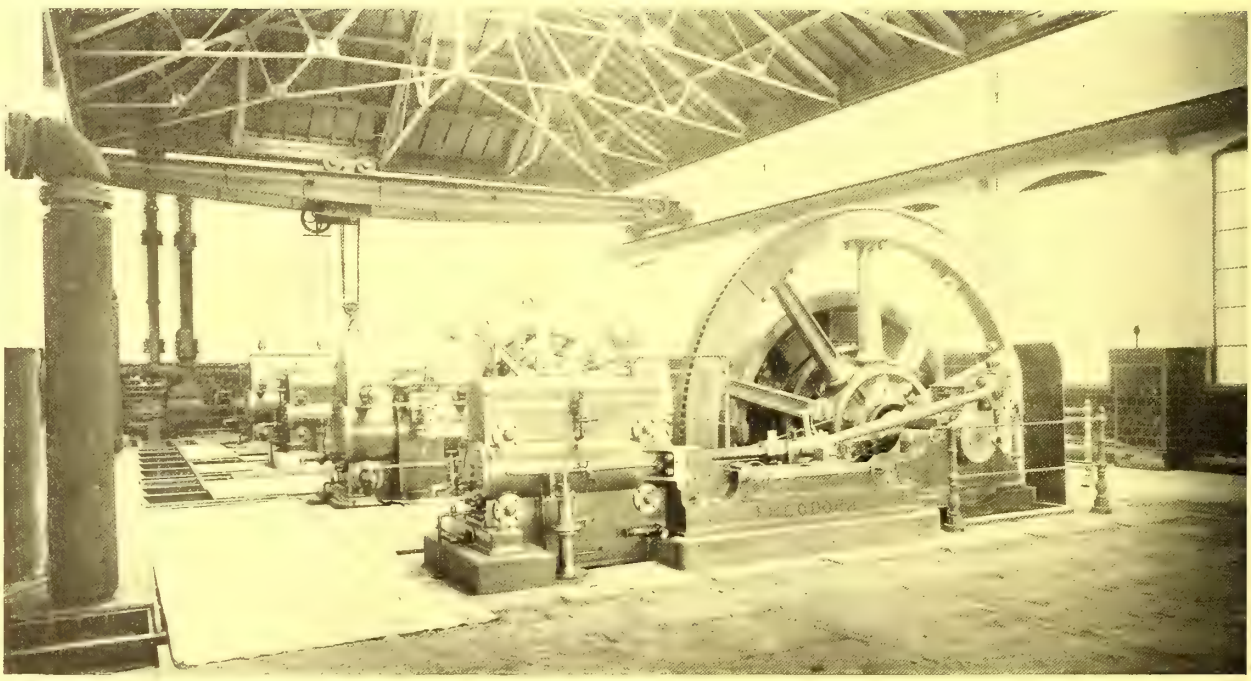

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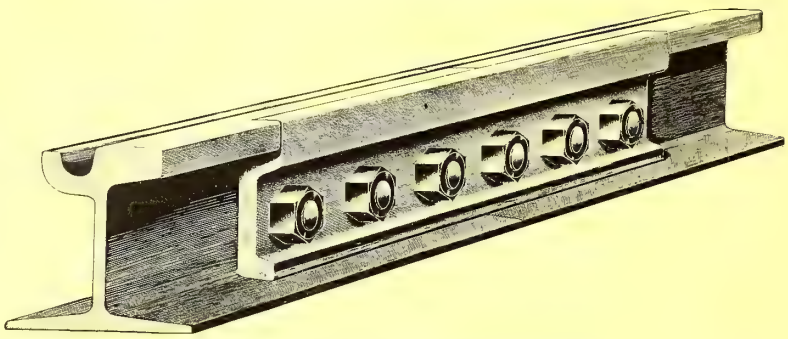

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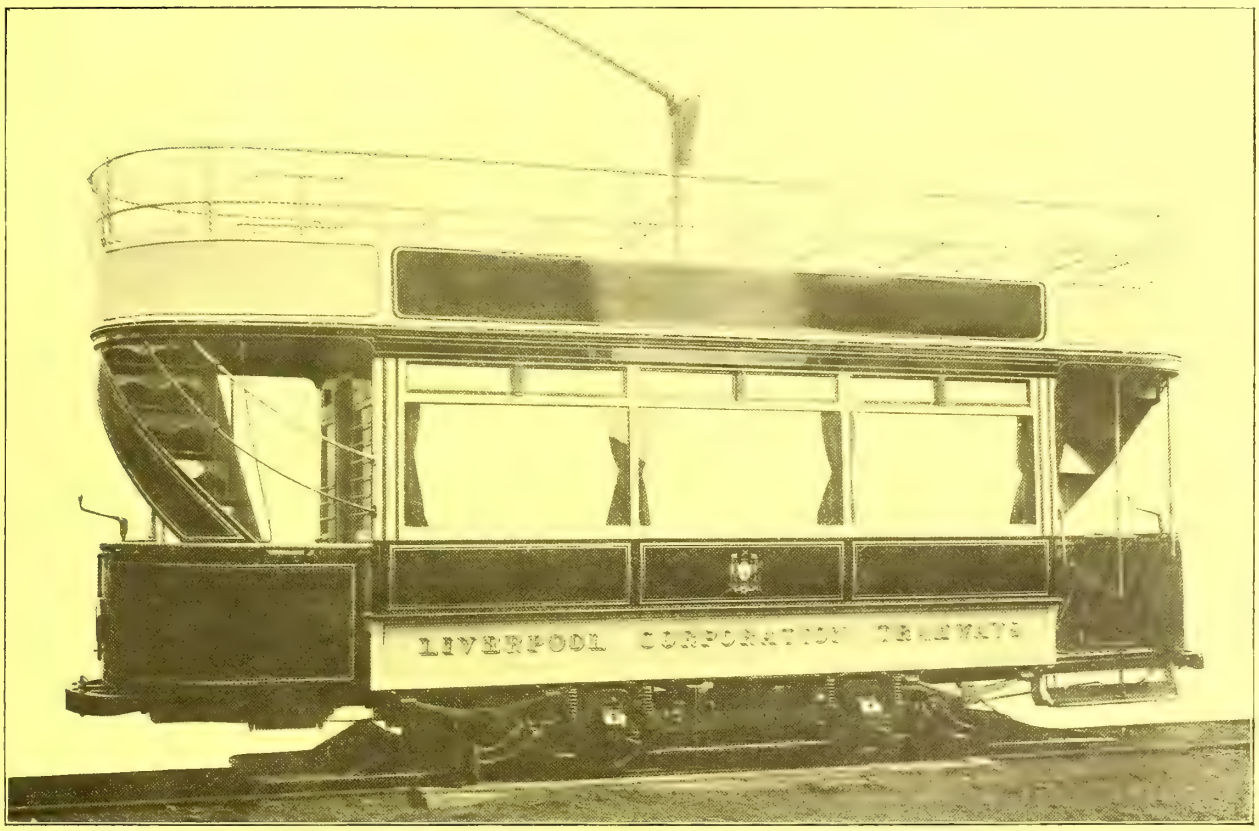

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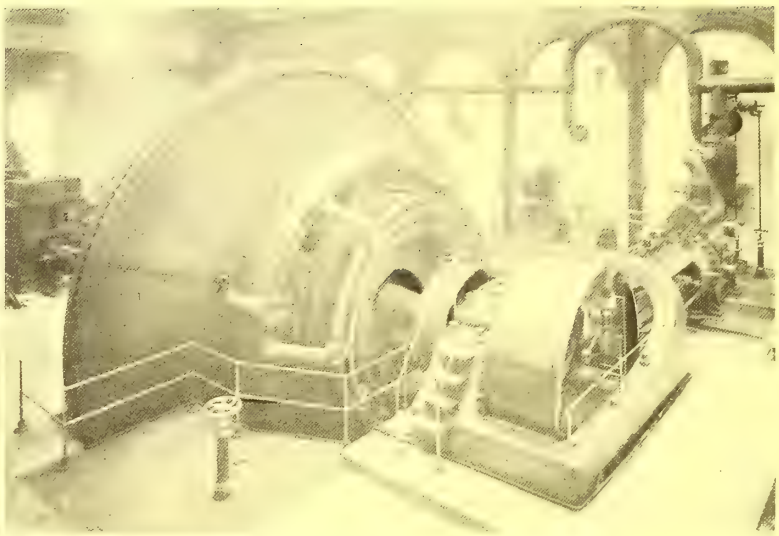

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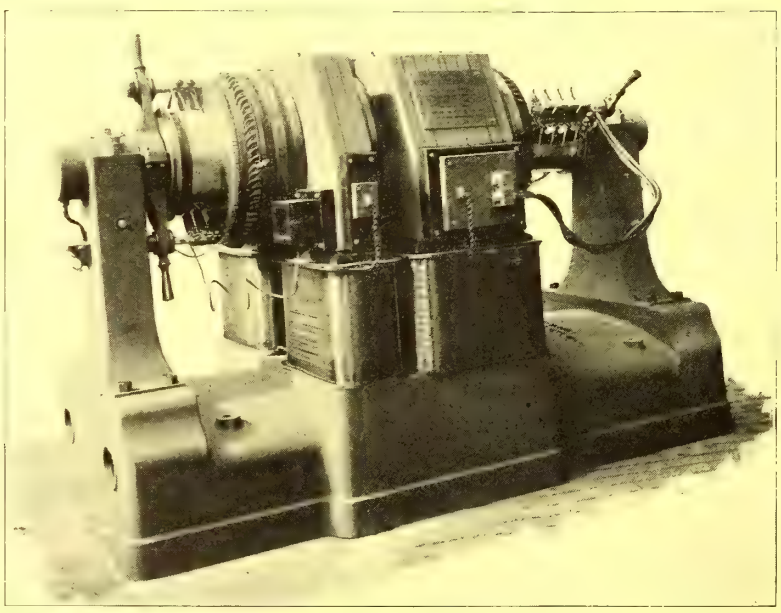

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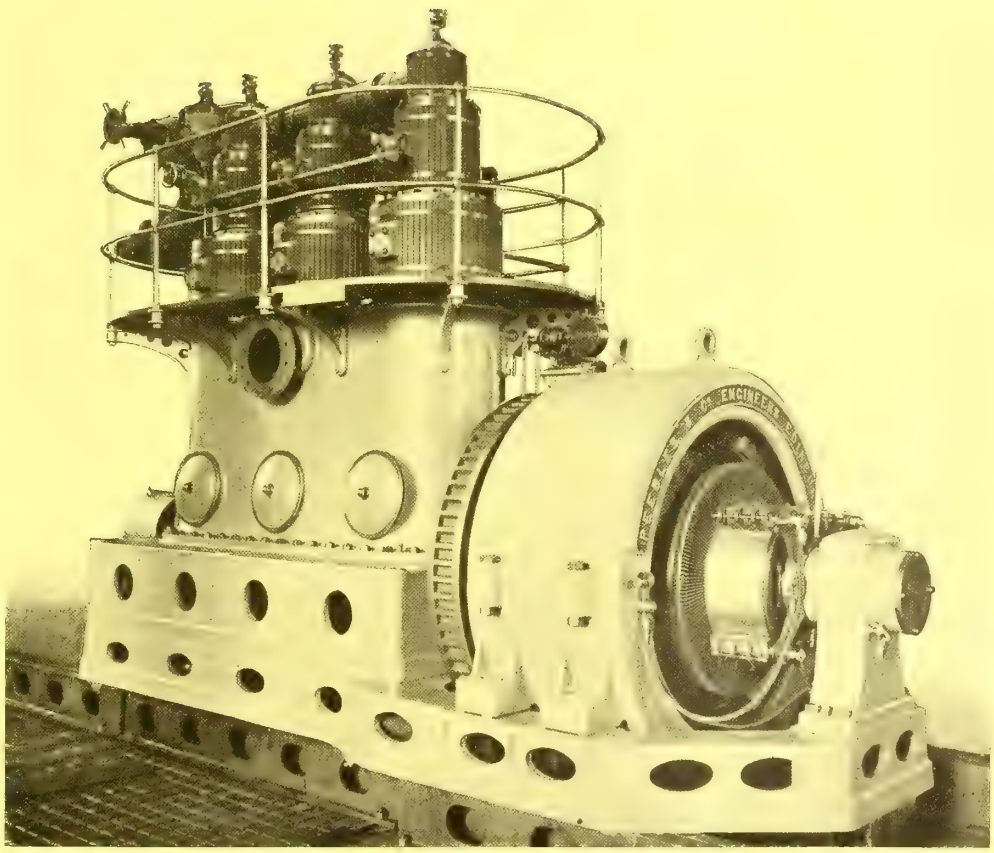

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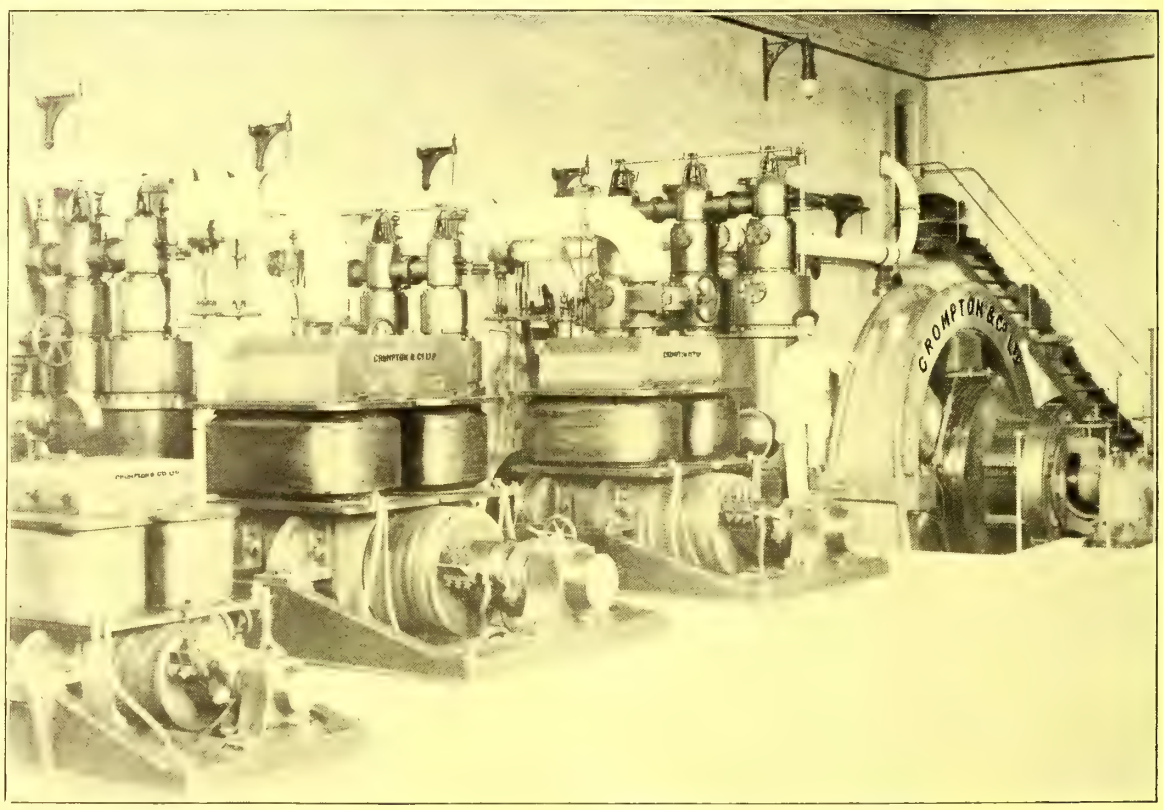

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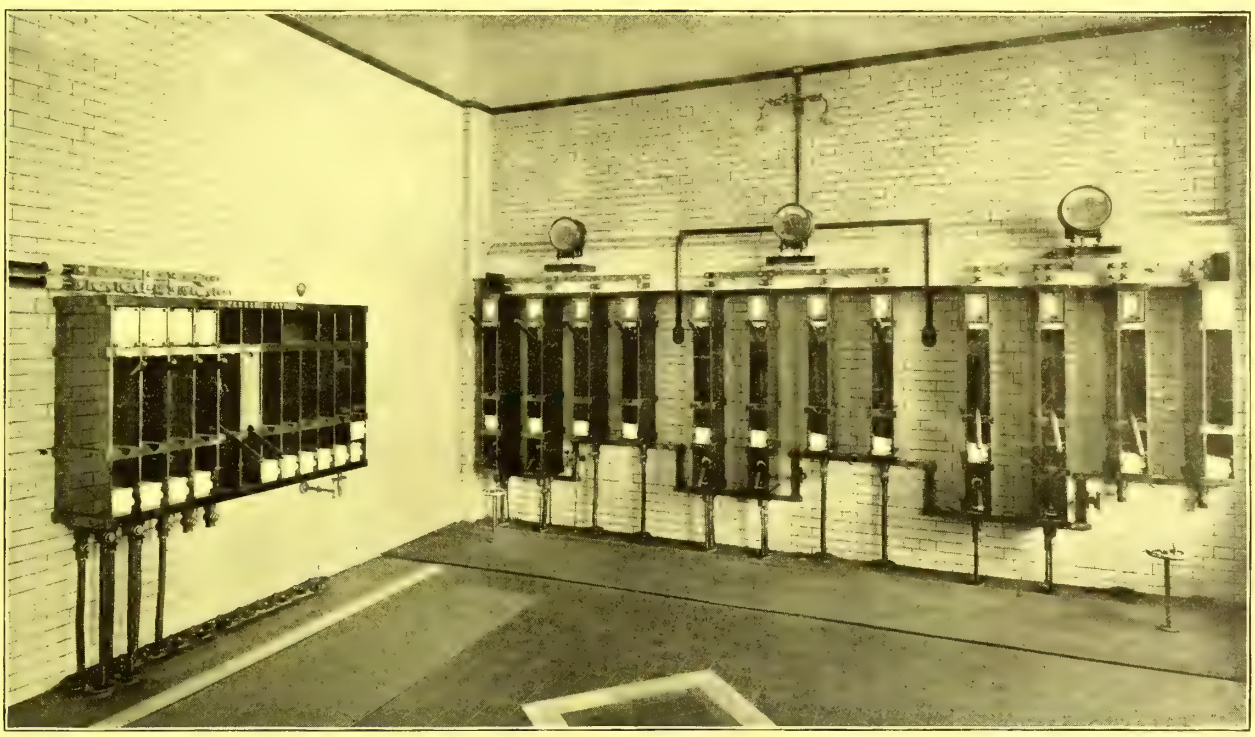

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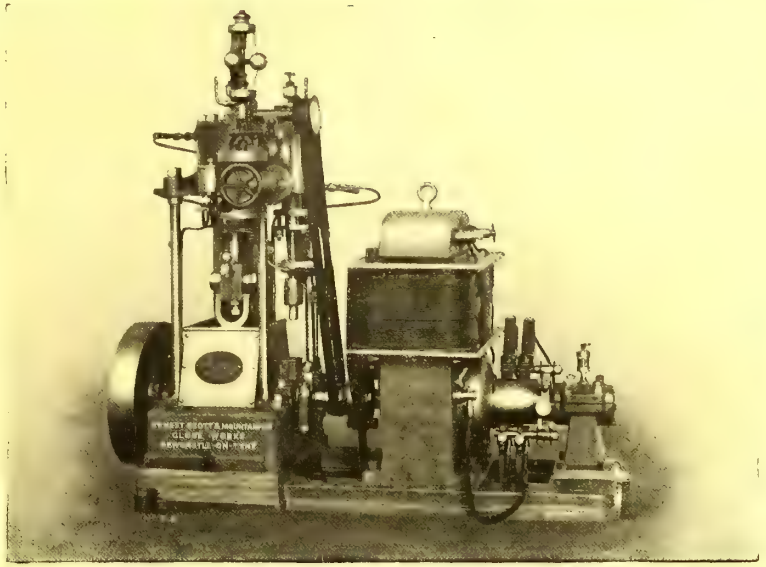

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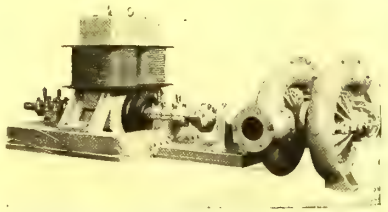

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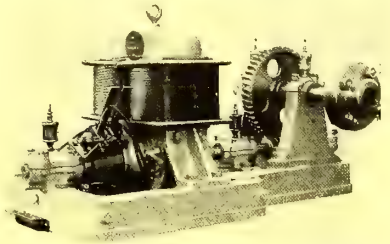

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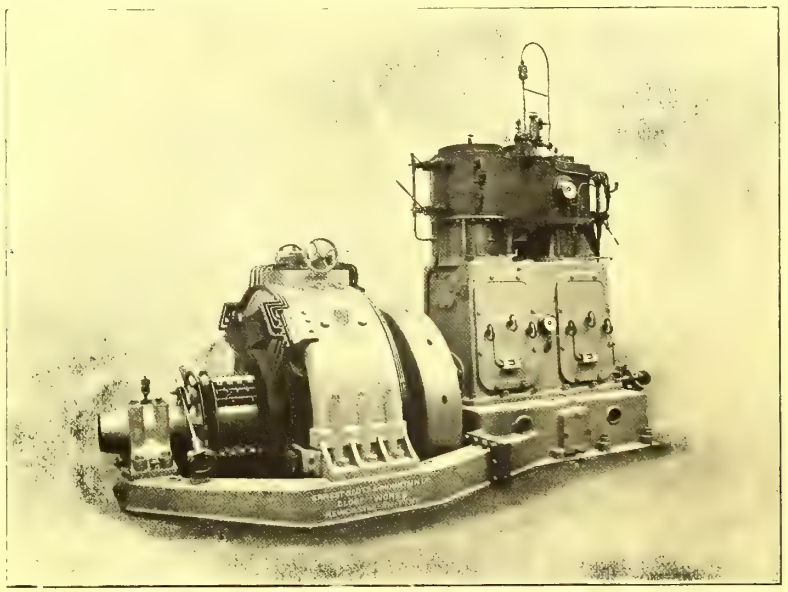

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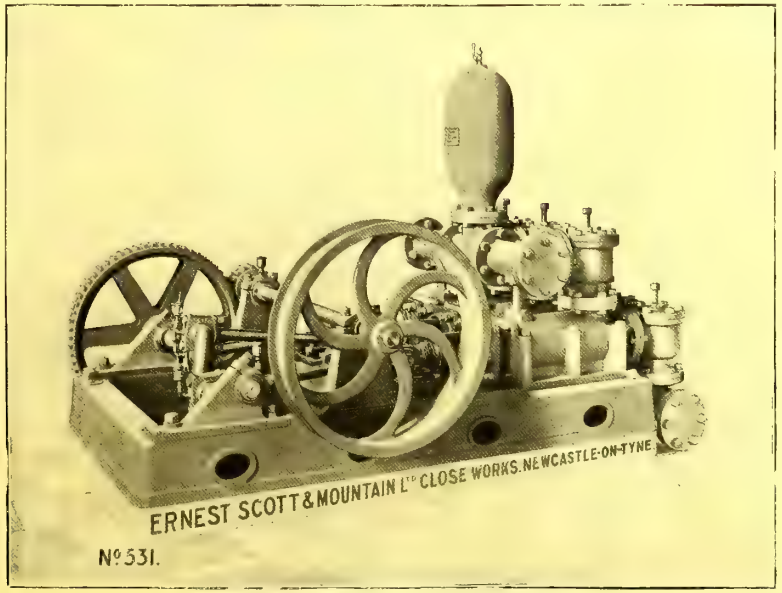

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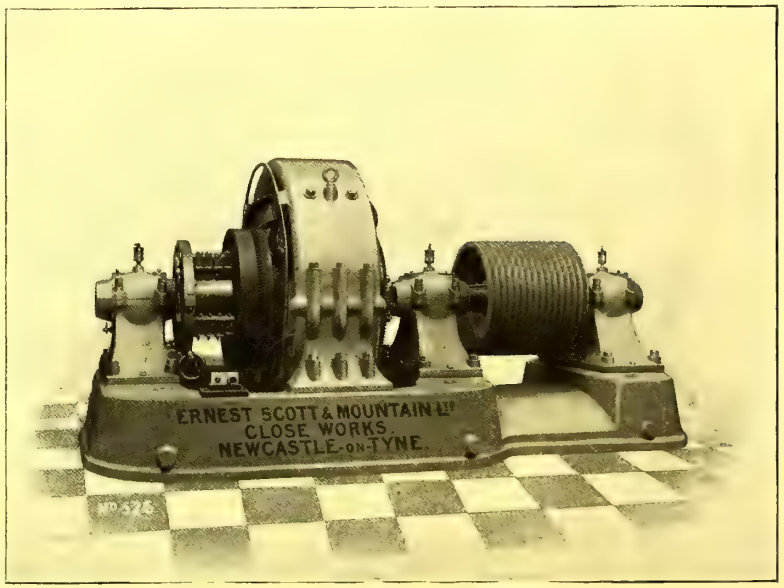

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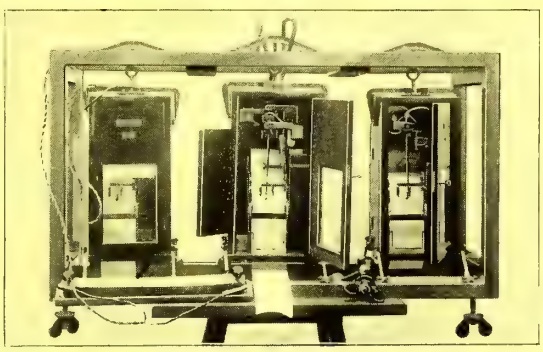

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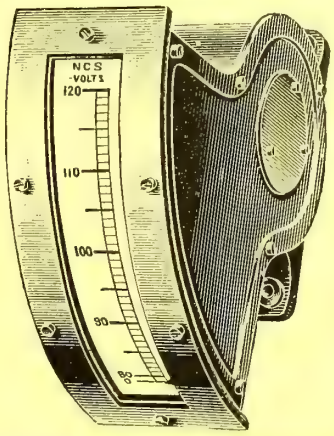

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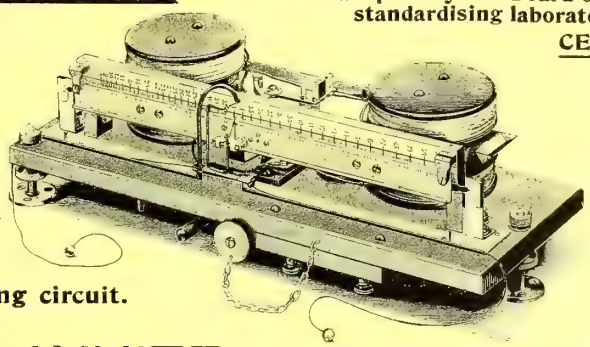

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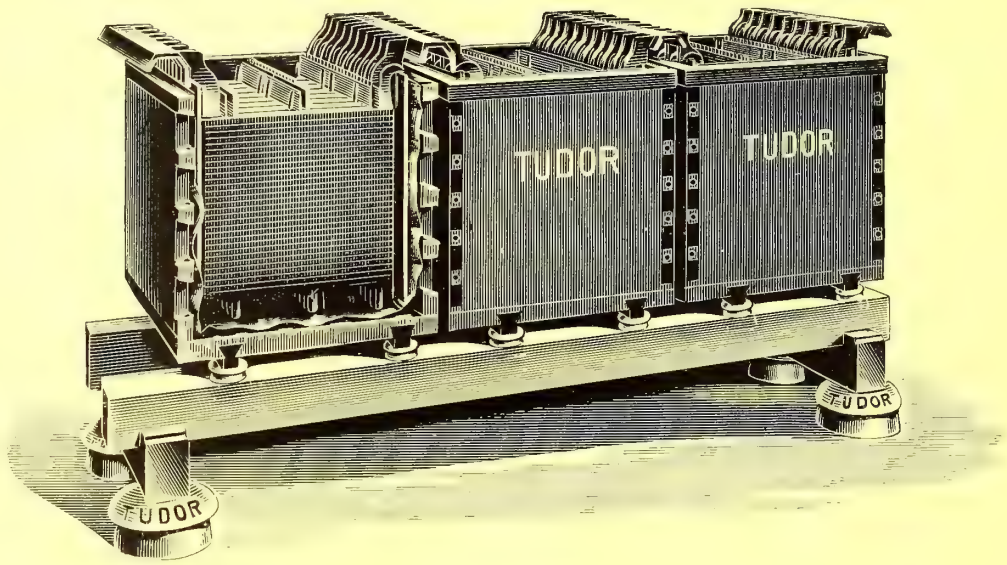

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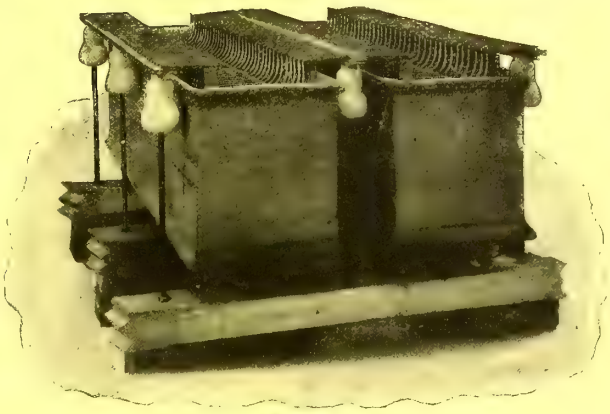

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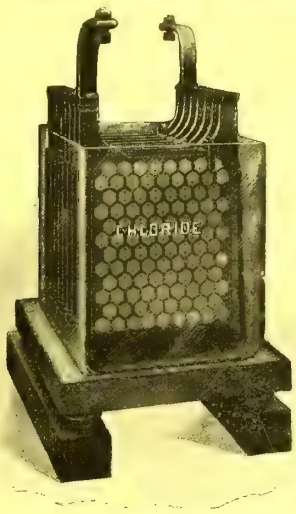
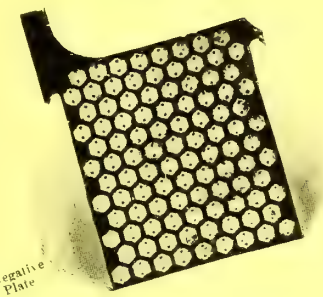
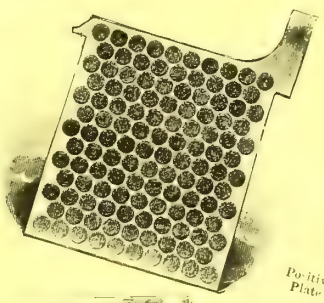




Negative Plate



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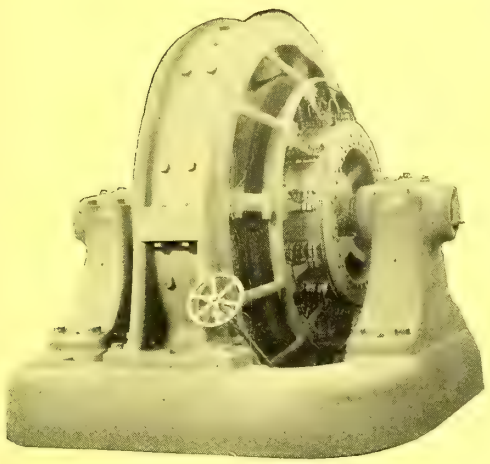

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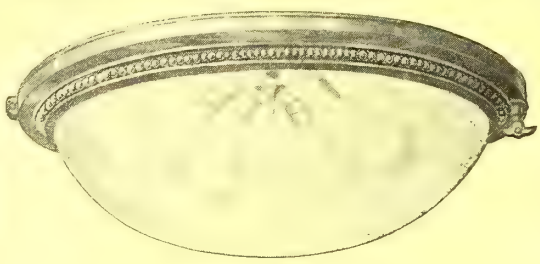

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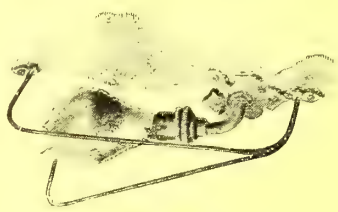

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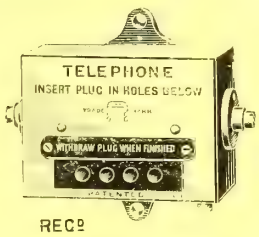

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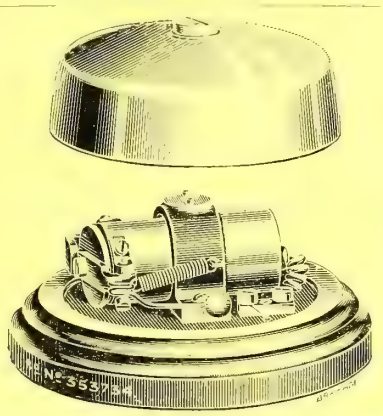

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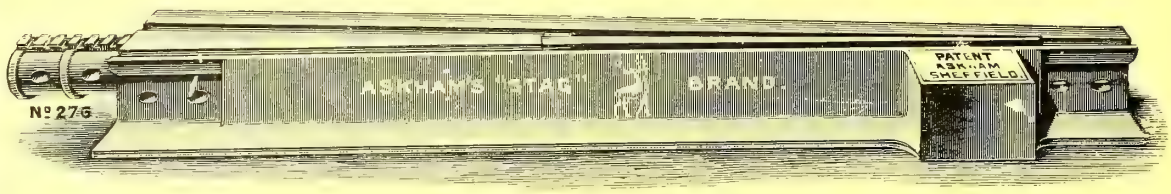

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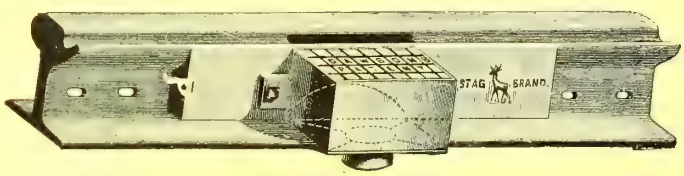

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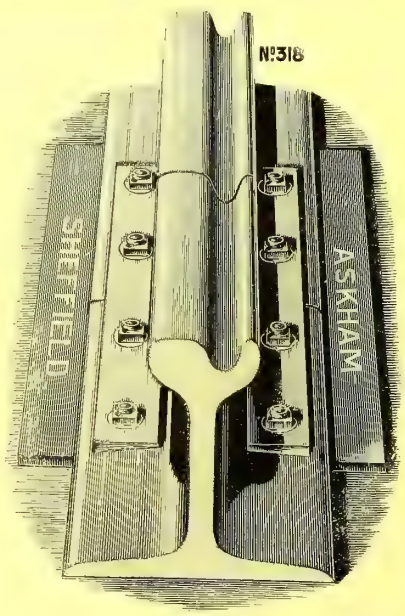

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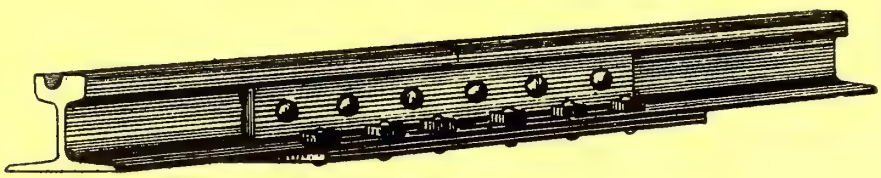

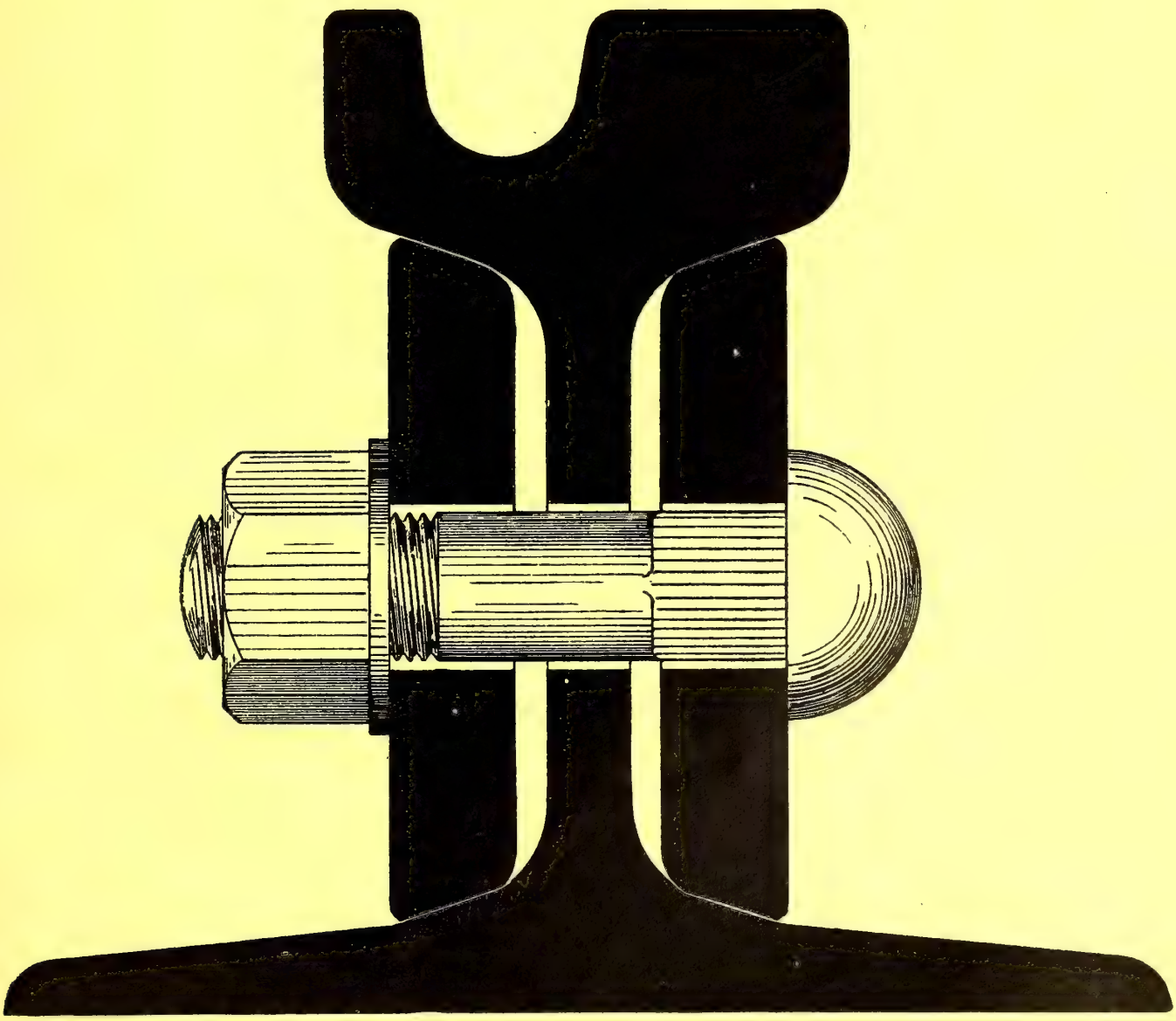

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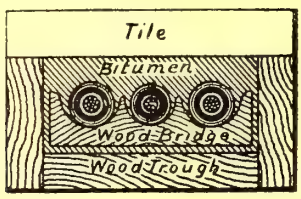

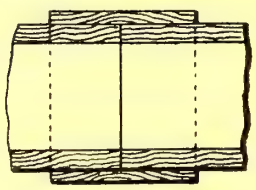

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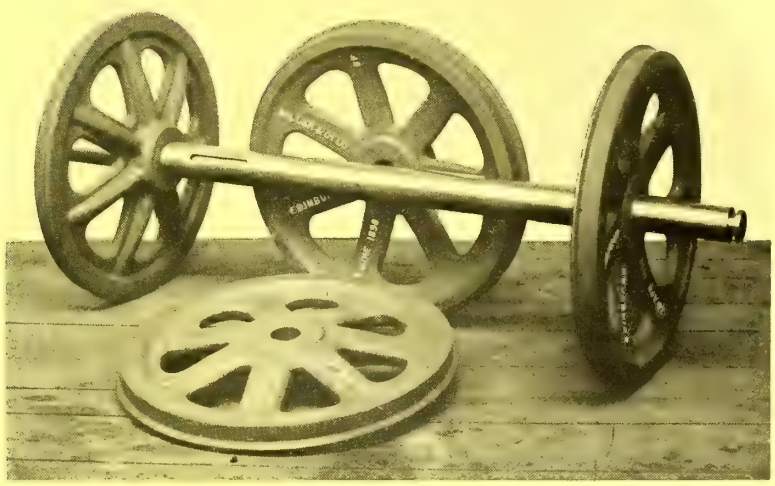

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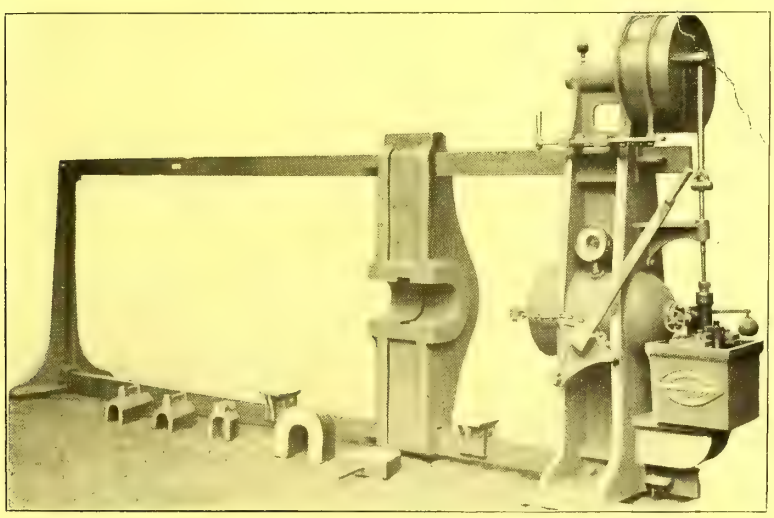

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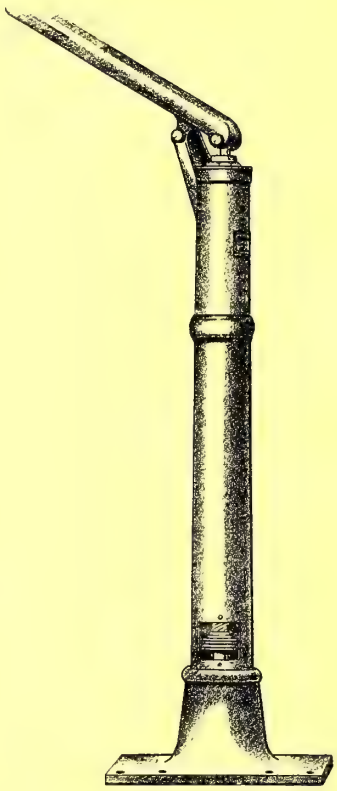
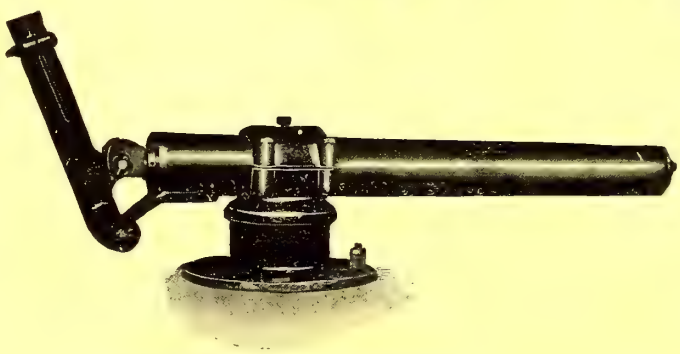


DOUBLE-DECK CAR TROLLEY

ESTLER BROTHERS



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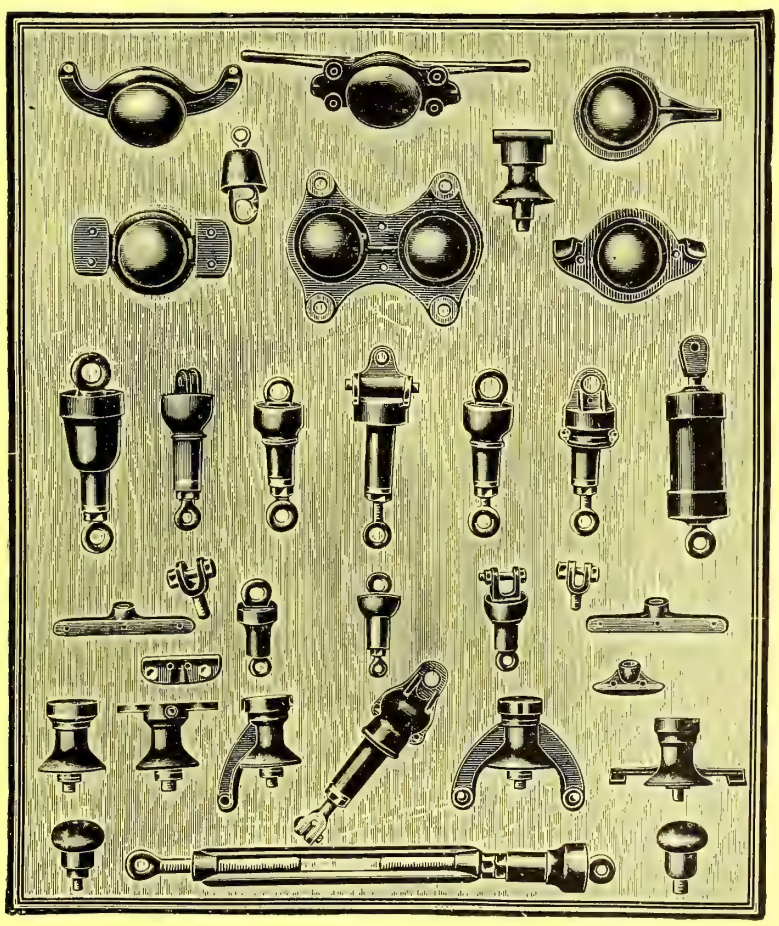

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Underground Cables for Electric Tramways, laid either on the

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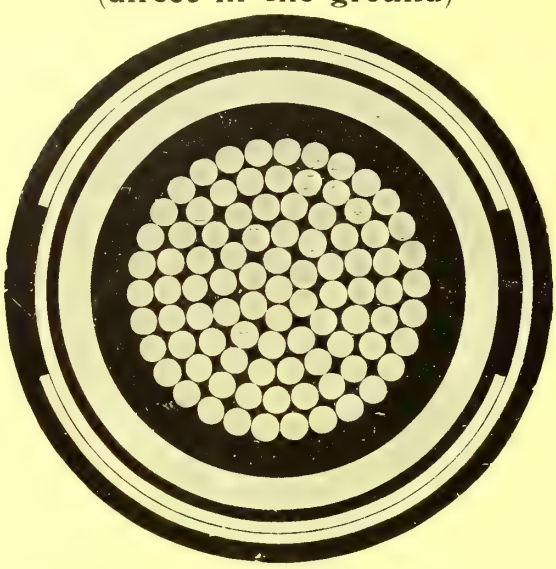
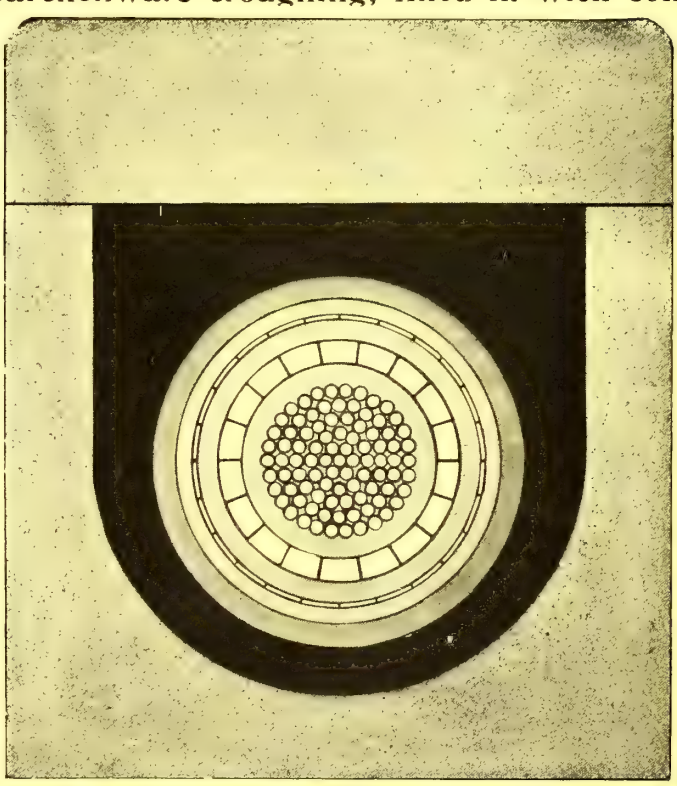


OR ON THE

SOLID SYSTEM

(with earthenware troughing, filled in with compound)



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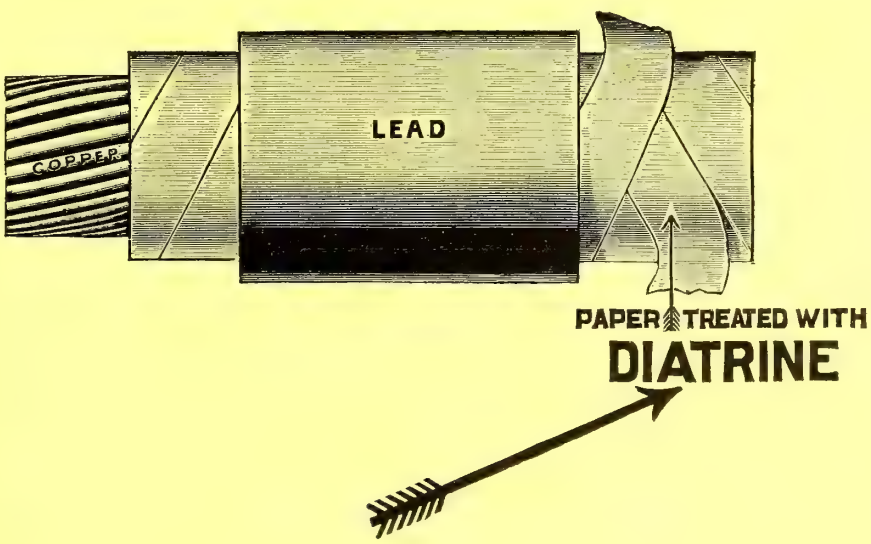

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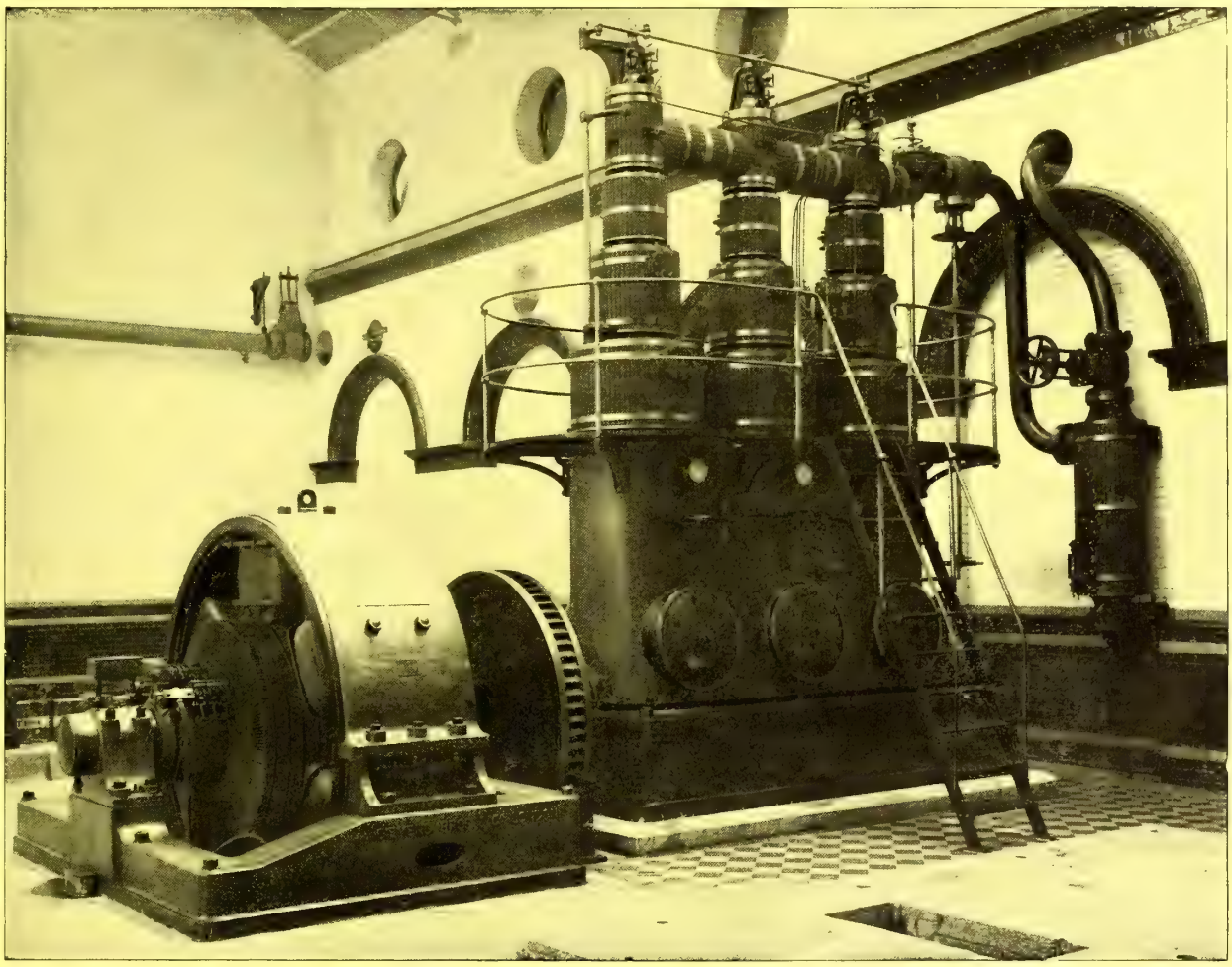

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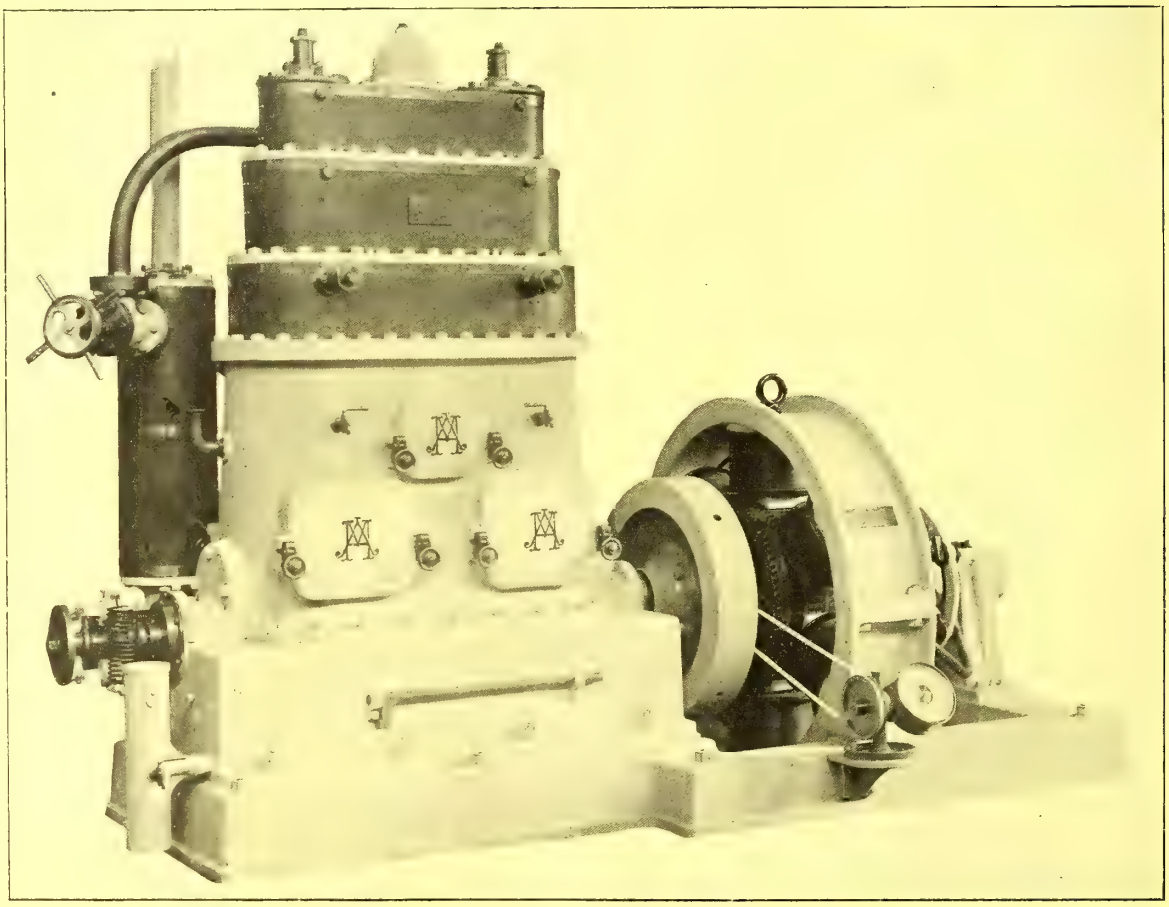

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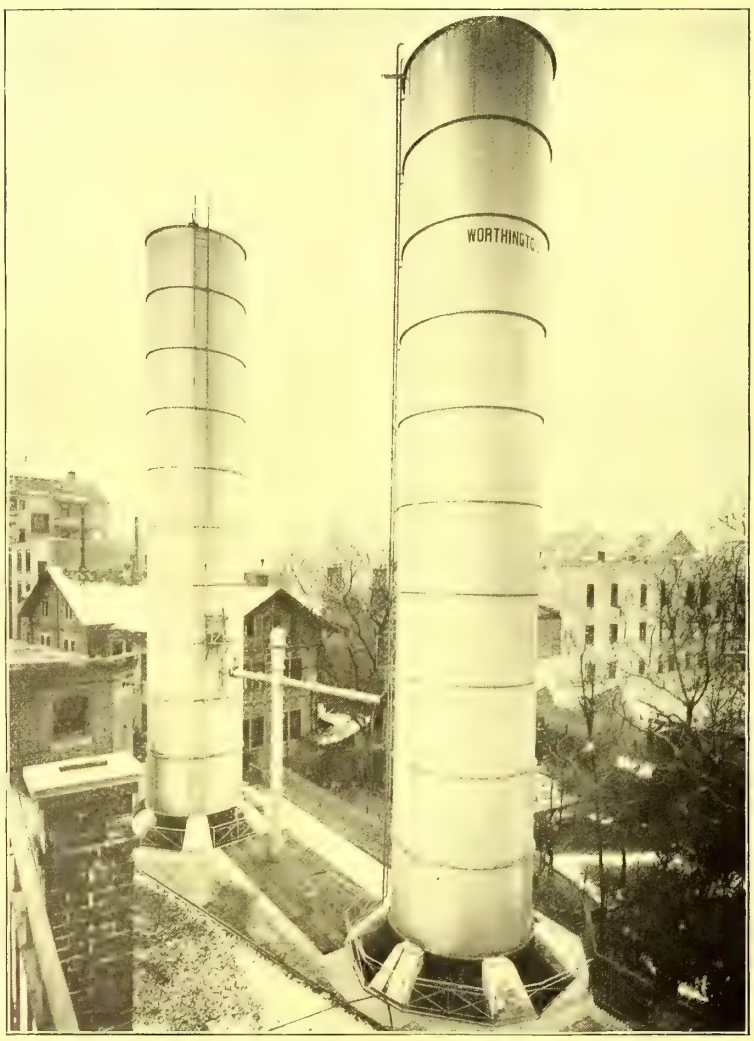

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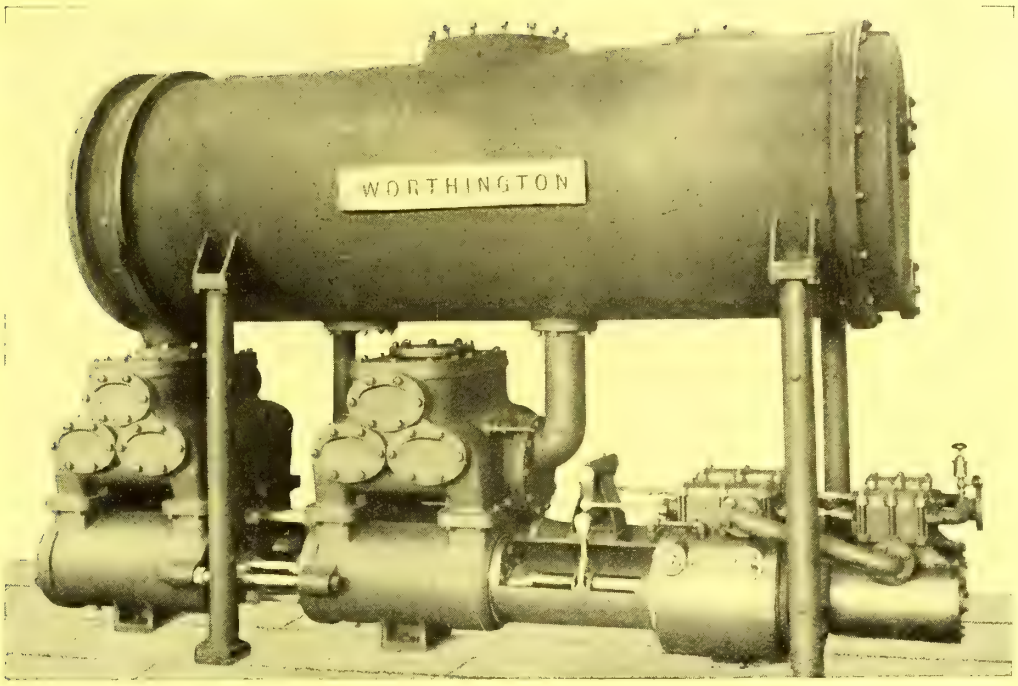

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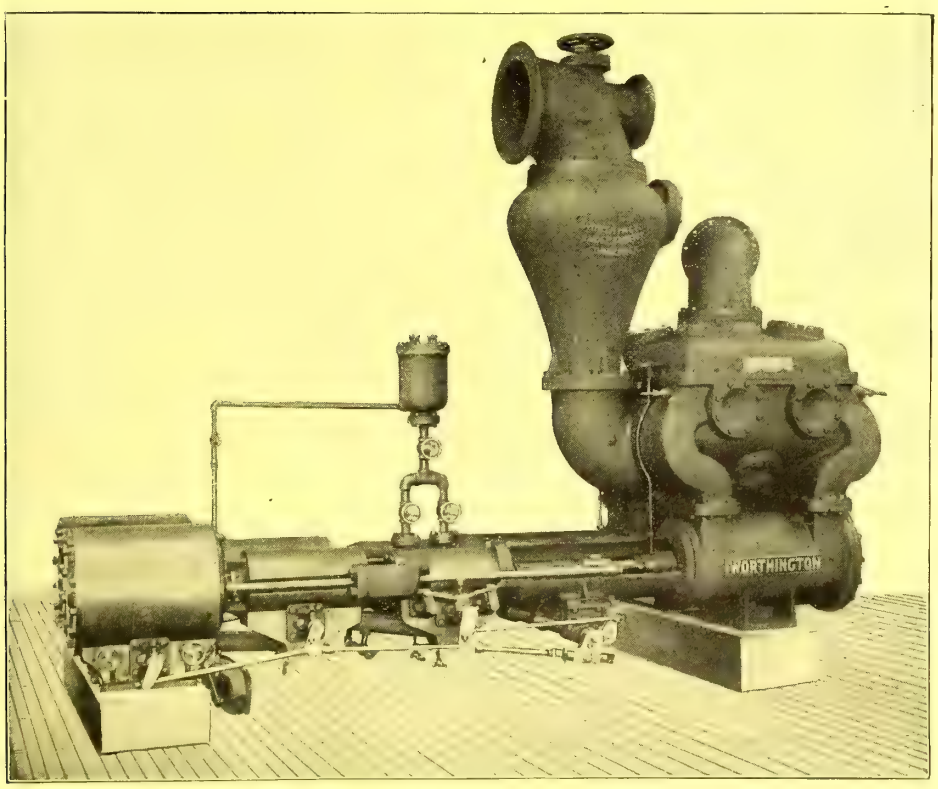

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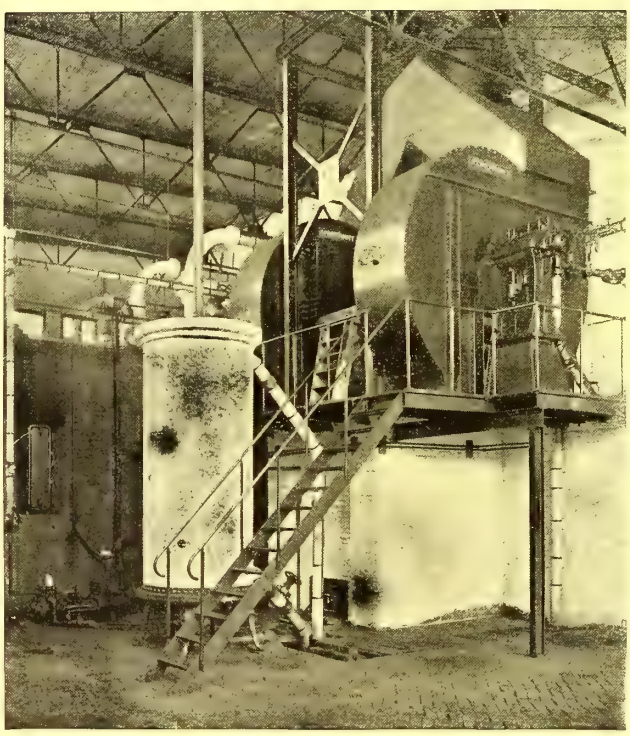

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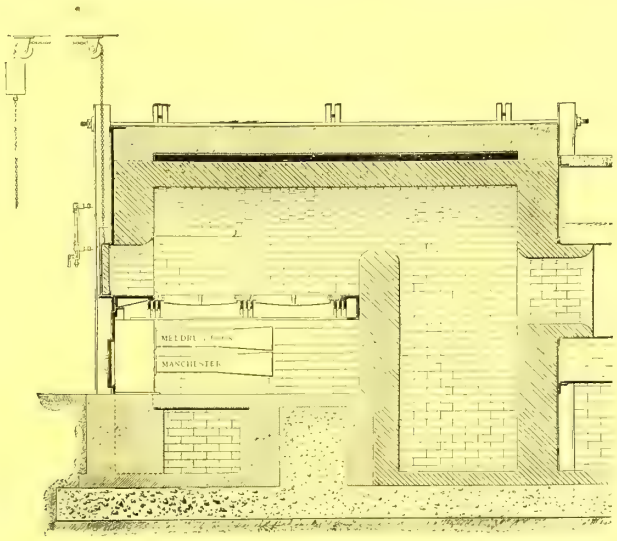

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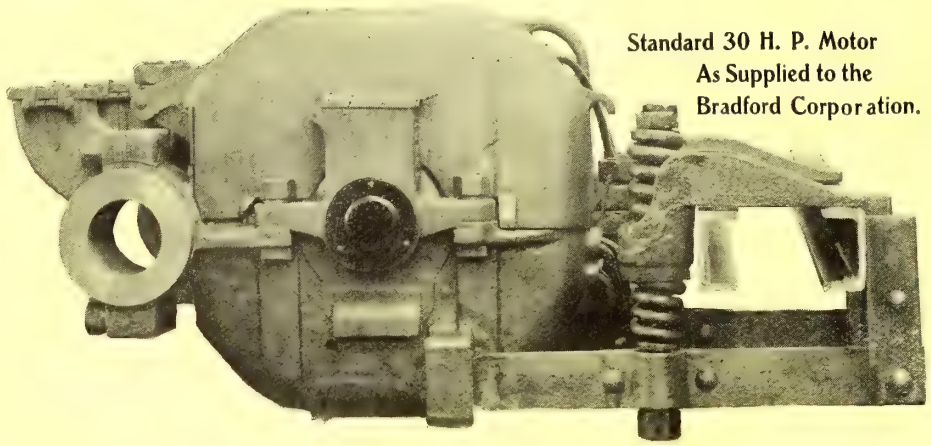

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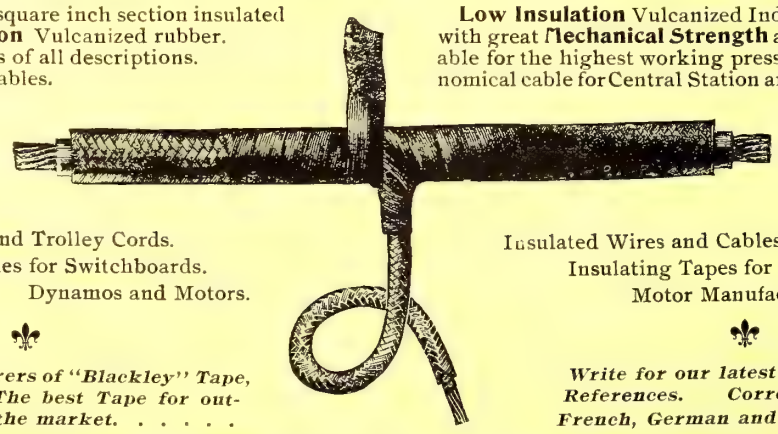

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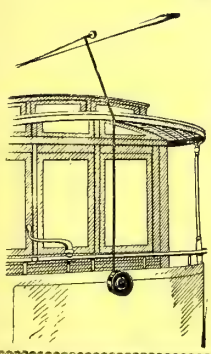

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The saving to overhead work and other advantages of this device are obvious. Trolley Rope always taut.
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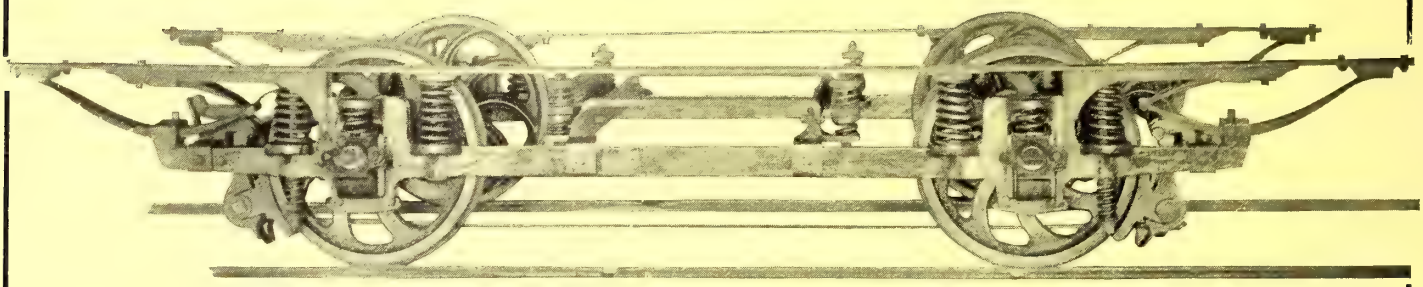

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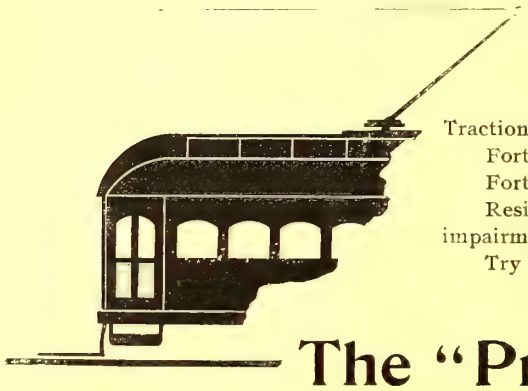
BEST DESIGN — EASIEST RIDING — LONGEST LIFE



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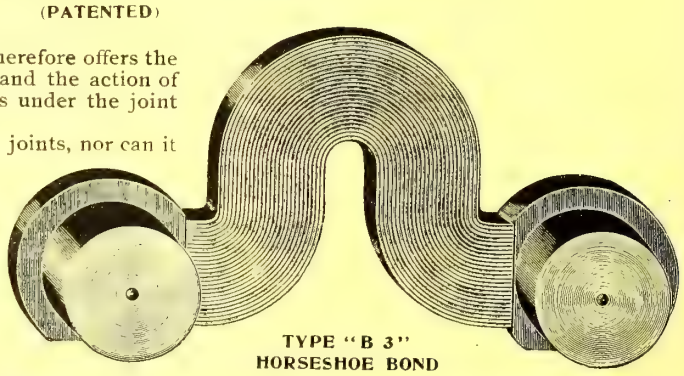

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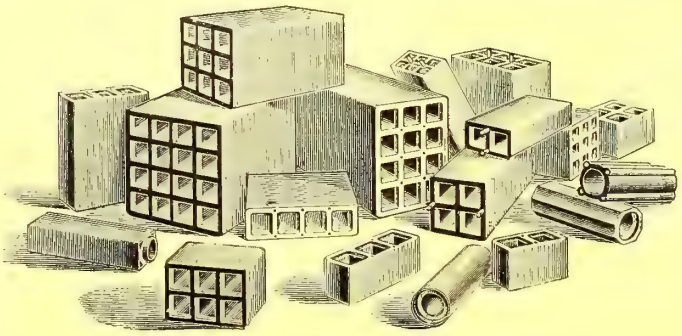

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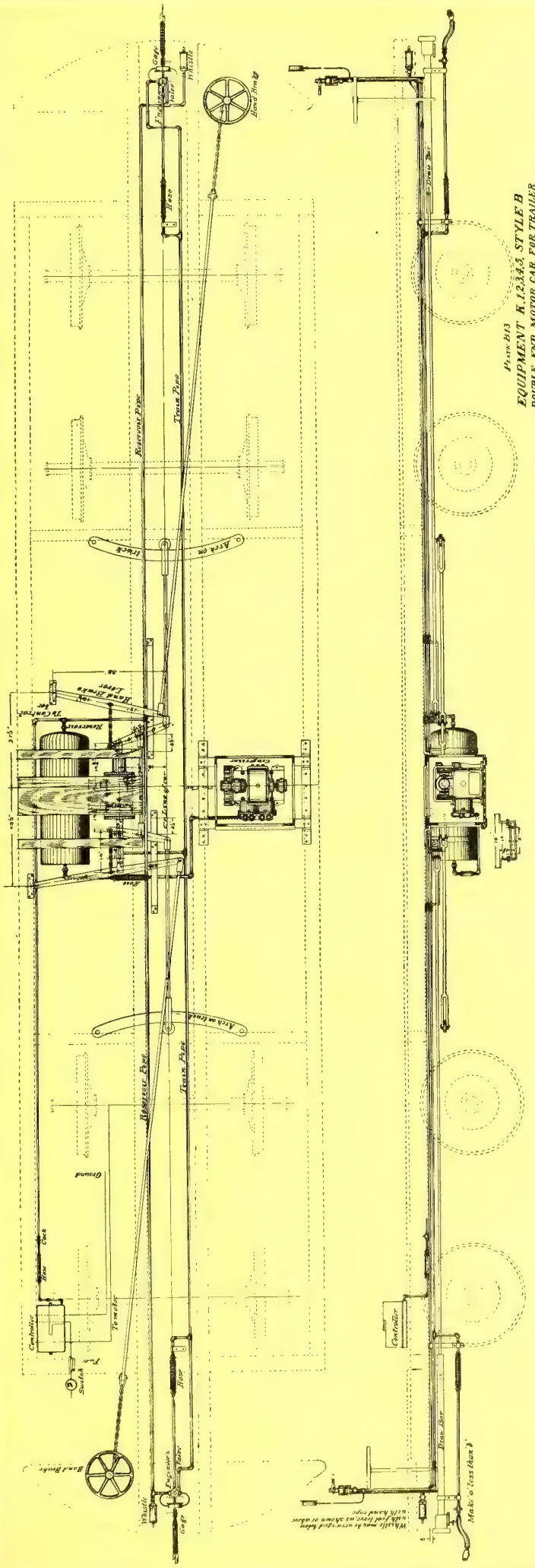

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Fall River & New Bedford Ry. Co.,	New Bedford, Mass.
Fox River Valley Electric Ry. Co.,	Appleton, Wis.
Detroit, Lake Shore & Mt. Clemens Ry. Co.,	Detroit, Mich.
Suburban Railway Co.,	Chicago, Ill.
Baltimore & Ohio Ry. Co.,	Baltimore, Md.
Cripple Creek District Ry. Co.,	Cripple Creek, Col.
Union Traction Co.,	Anderson, Ind.
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Lowell, Lawrence & Haverhill Ry. Co.,	Lowell, Mass.
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Brooklyn Heights R. R. Co.,	Brooklyn, N. Y.
West Chester Traction Co.,	Philadelphia, Pa.
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Union Railroad Co.,	Providence, R. I.
Hartford Street Railway Co.,	Hartford, Conn.
Providence & Taunton St. Railway Co.,	Bridgeport, Conn.
Holbrook & Weymouth St. Railway Co.,	Holbrook, Mass.
Boston & Maine R. R.,	Boston, Mass.
Lorain Street Railway Co.,	Lorain, Ohio
Dayton & Xenia Traction Co.,	Dayton, Ohio
South Dover Marble Co.,	New York City, N. Y.
Norfolk & Ocean View Ry. Co.,	Norfolk, Va.
Twin City Rapid Transit Co.,	Minneapolis, Minn.
Memphis Street Railway Co.,	Memphis, Tenn.
Los Angeles & Pacific Ry. Co.,	Los Angeles, Cal.
Chicago & Milwaukee Electric Ry. Co.,	Highwood, Ill.
Dayton, Springfield & Urbana Ry. Co.,	Springfield, O.
Citizens Traction Co.,	Oshkosh, Wis.
Chicago, Harvard & Geneva Lake Ry. Co.,	Harvard, Ill.
San Antonio Brewing Association,	San Antonio, Texas
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We manufacture complete systems of both Straight and Automatic Air, and both are represented in above list.

The above list appeared in the October issue of this Journal for 1899. We could now increase it several hundred per cent, but prefer to leave it unchanged, thereby referring to parties, all of whom have had enough experience with the apparatus in actual service to qualify them to report thereon from personal knowledge.

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See also pages 202 and 203.

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See pages 211 and 264 of this issue.

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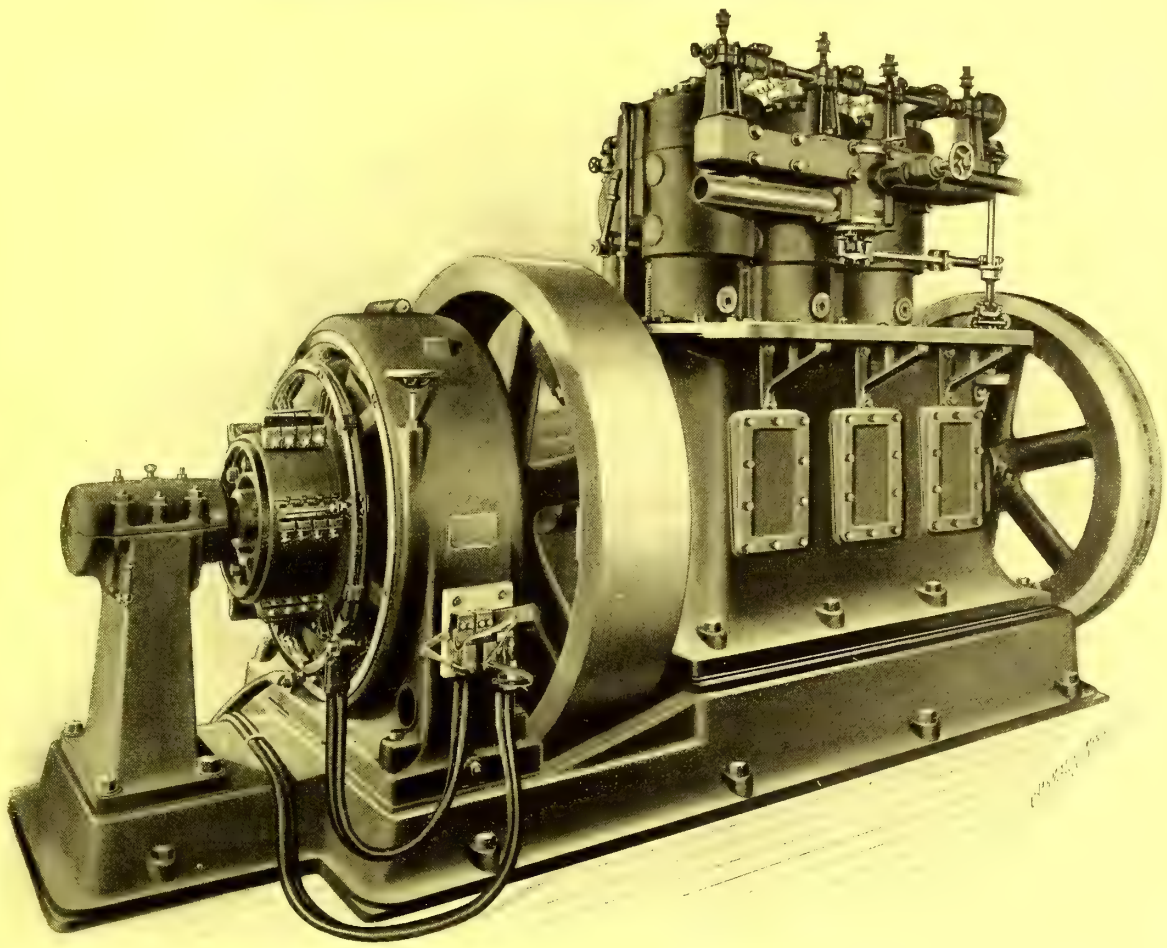
No Limitations so Objectionable in Other Makes



Westinghouse Gas Engine Direct Connected to Westinghouse Generator.

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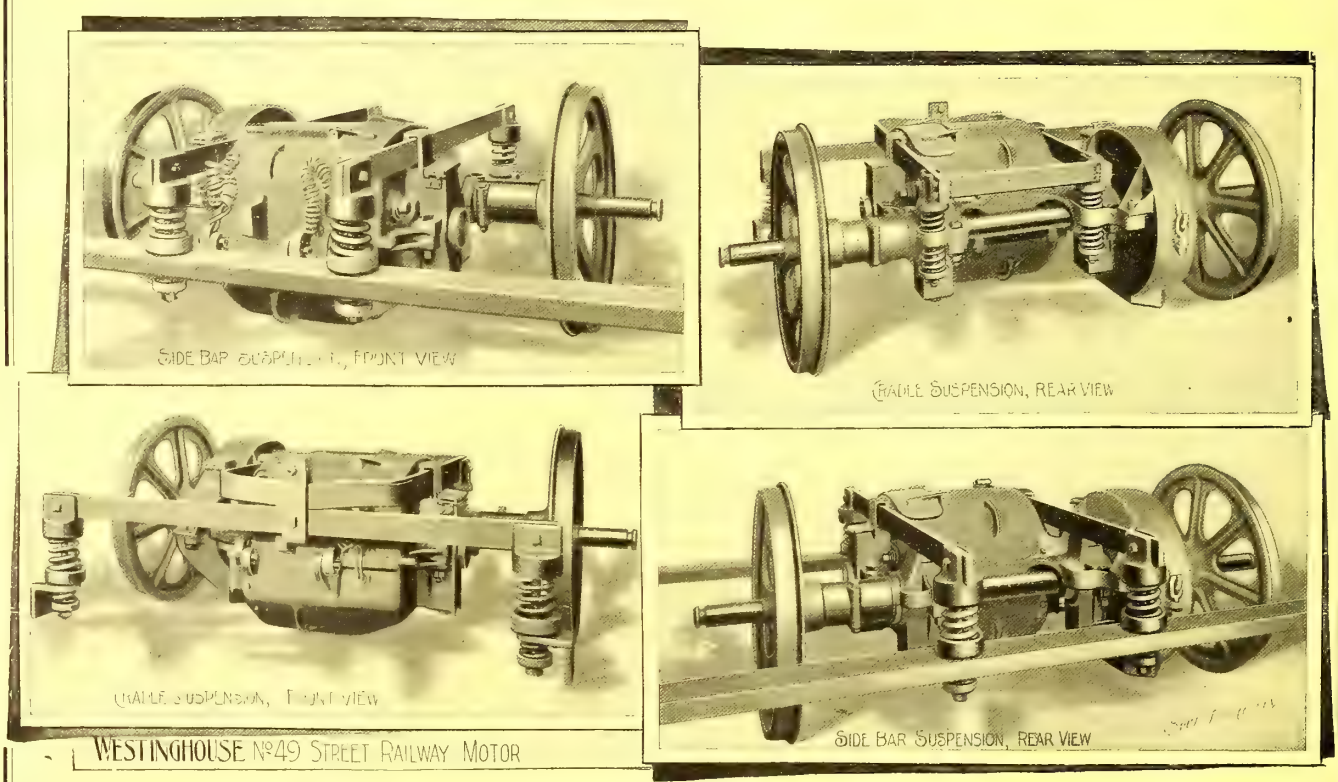

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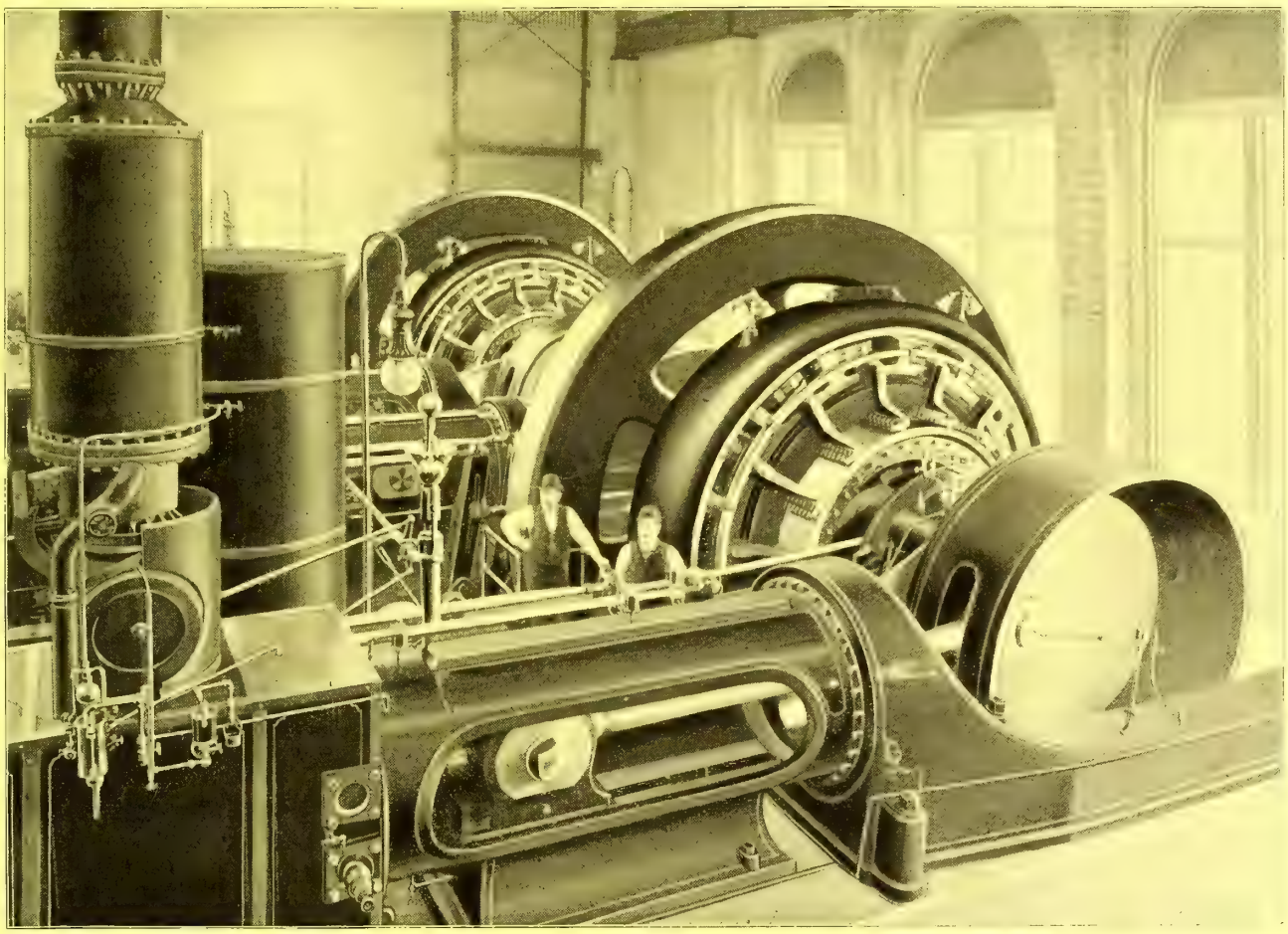

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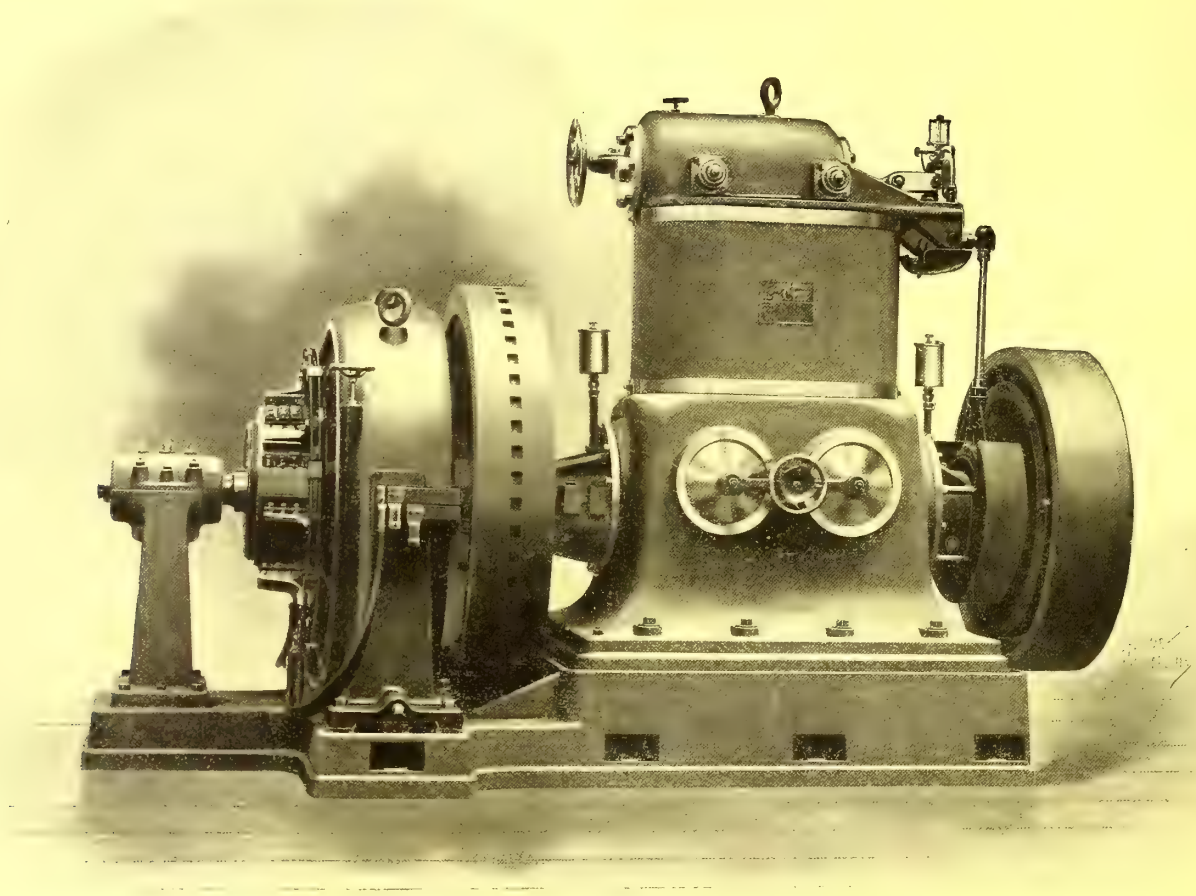

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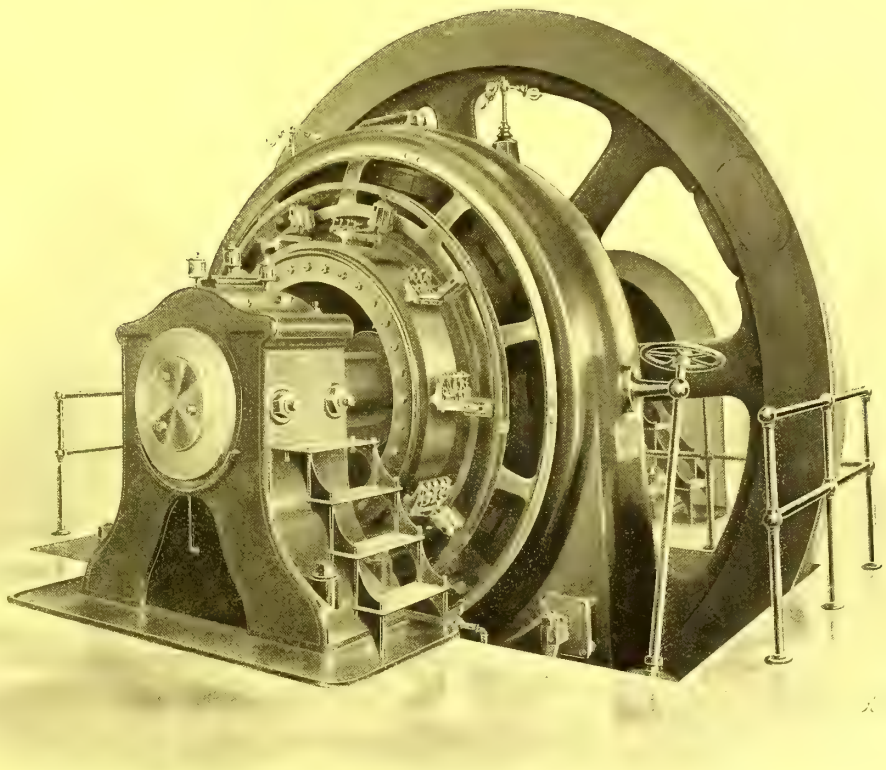

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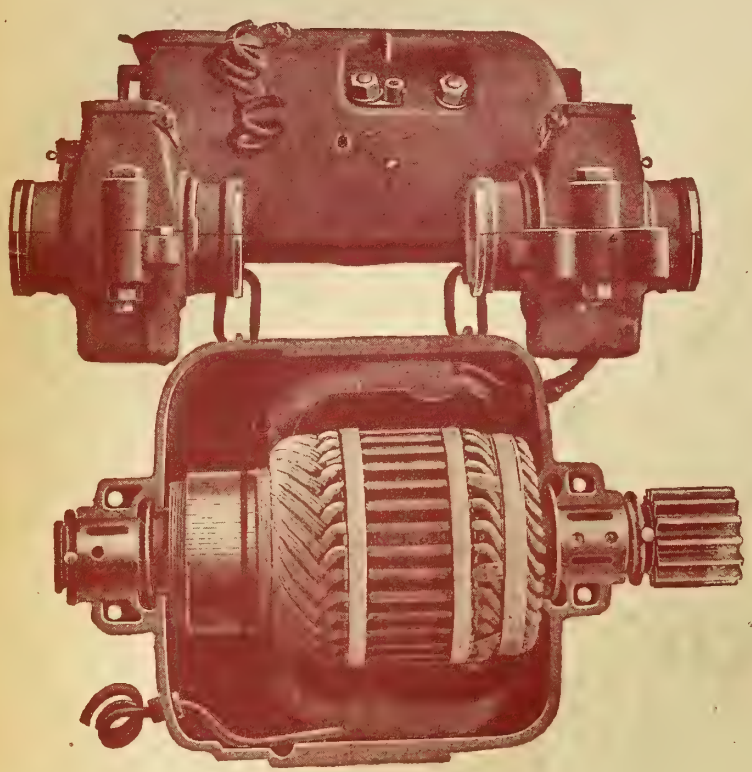
Motive Power Systems

STREET RAILWAY JOURNAL
October, Nineteen Hundred

FOR ALPHABETICAL INDEX TO ADVERTISERS, SEE PAGES 5, 6, 7

SURFACE AND ELEVATED

RAILWAY MOTORS



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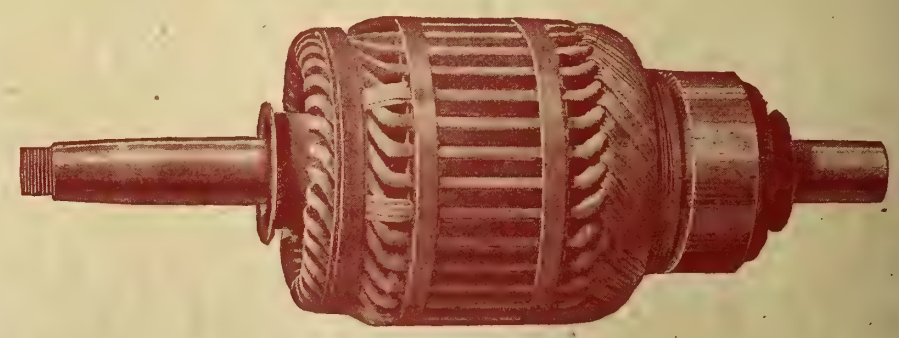

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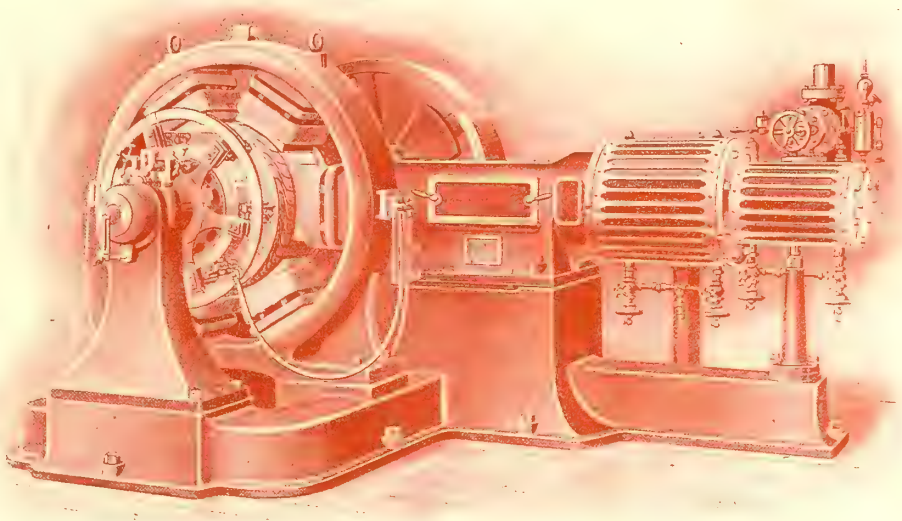

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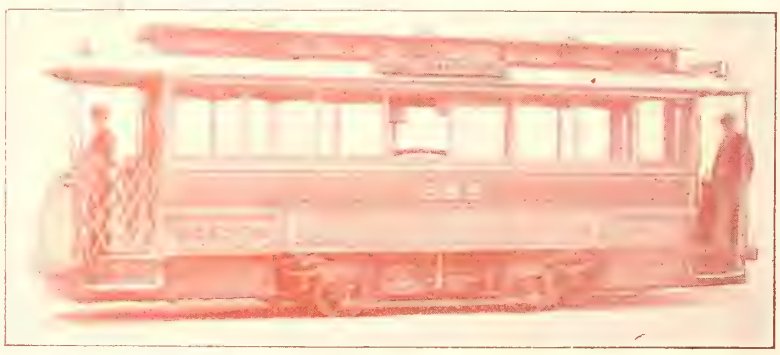

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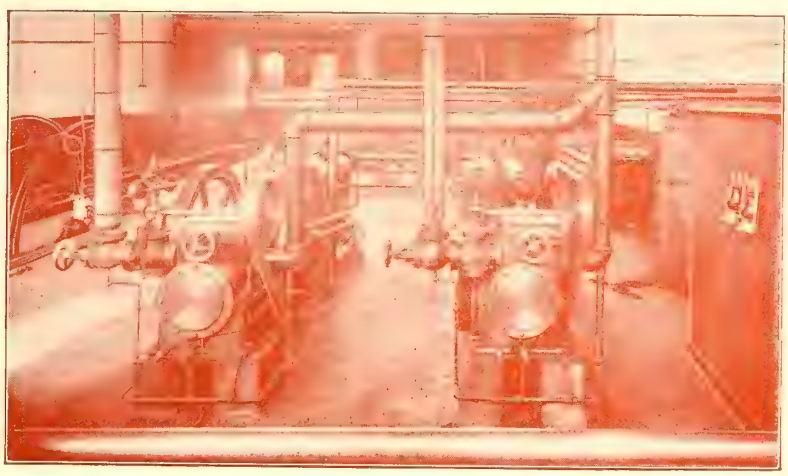

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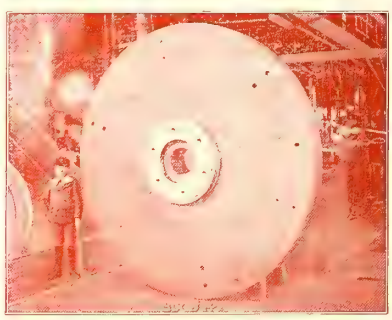

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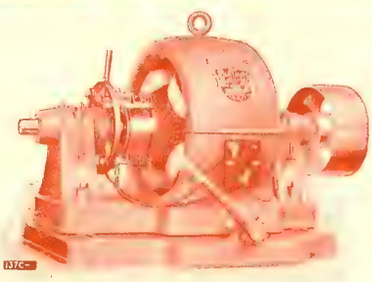
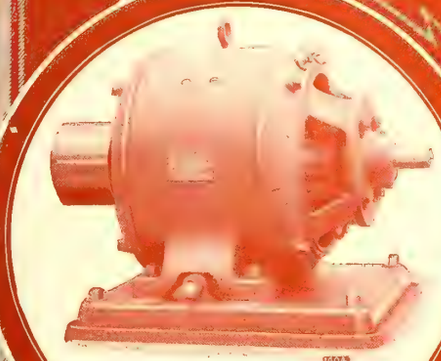


75 K W. TYPE "H" GENERATOR.
DESCRIBED IN BULLETIN 32-A



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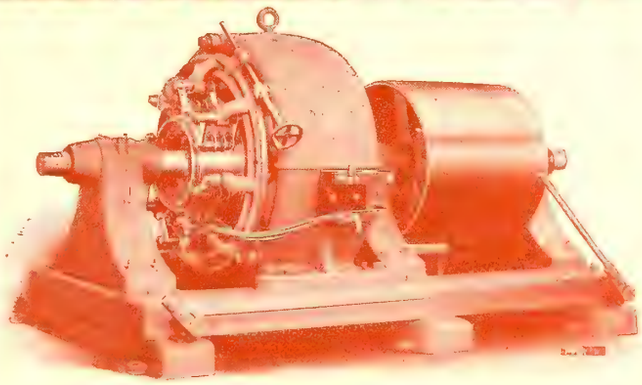

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Keene Electric Railway Co., Keene, N. H.		
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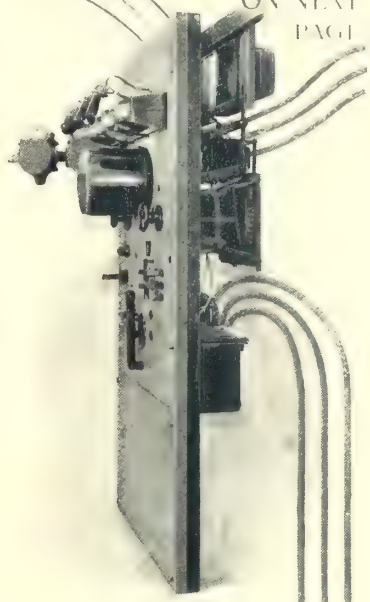
HIGH TENSION LEAD TO SUB STATION SHOWN ON NEXT PAGE



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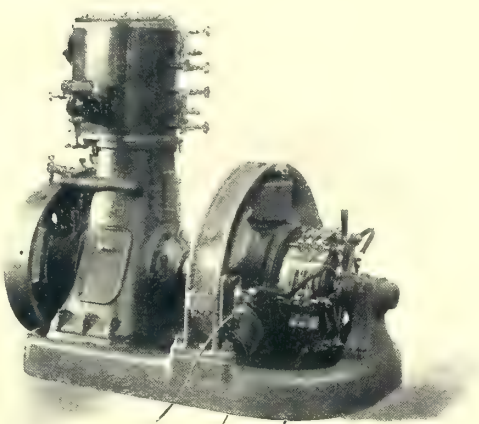
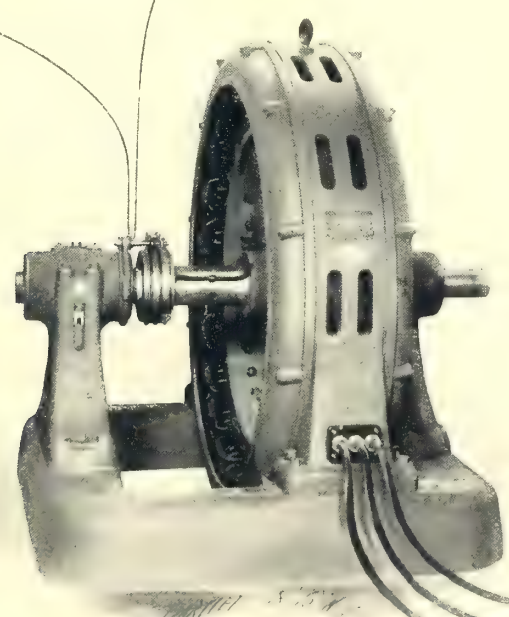
Manufactures complete electrical equipments for street railways, including wire and cable, and furnishes from its own shops all electrical apparatus between the engine shaft and the car axle.



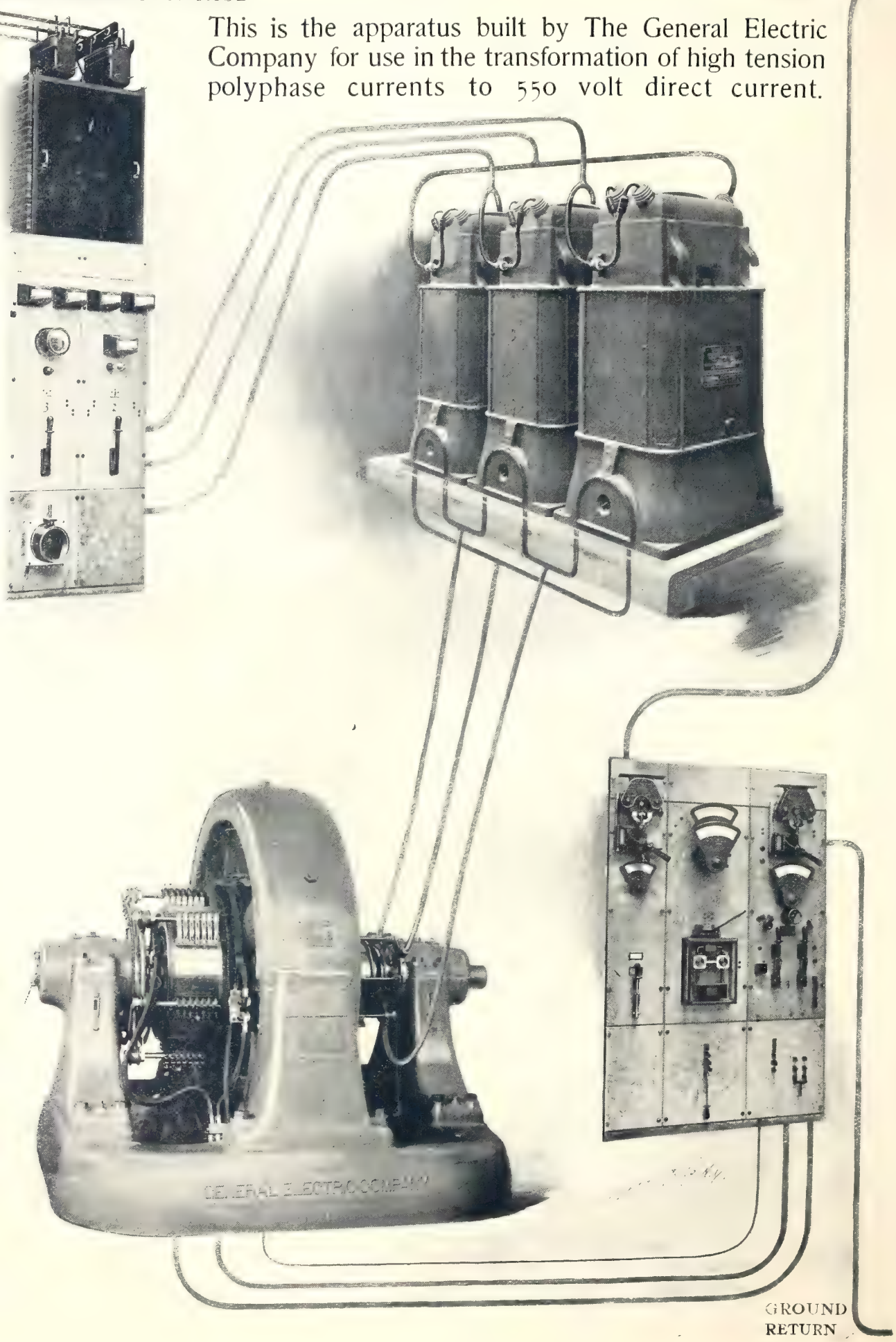


This page illustrates the electrical equipment of a Railway Power House, generating high tension polyphase currents for long distance roads. The other parts of the system appear on the following pages.

HIGH TENSION LINE
FROM GENERATING STATION
SHOWN ON PREVIOUS PAGE

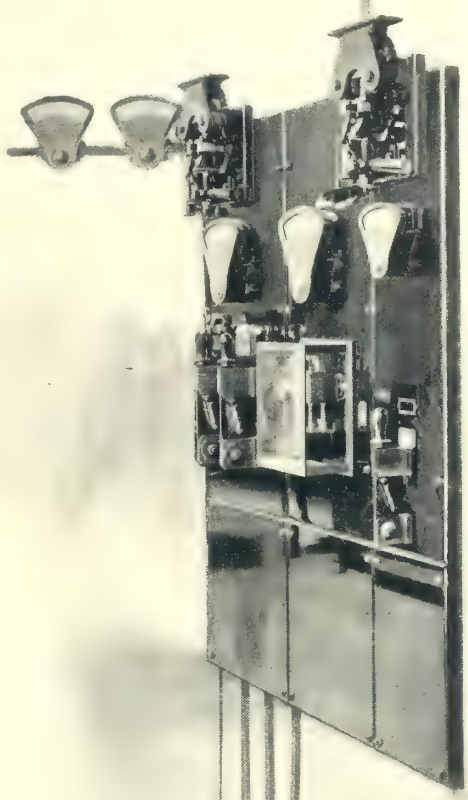
500 VOLT FEEDER
TO TROLLEY WIRE

This is the apparatus built by The General Electric Company for use in the transformation of high tension polyphase currents to 550 volt direct current.

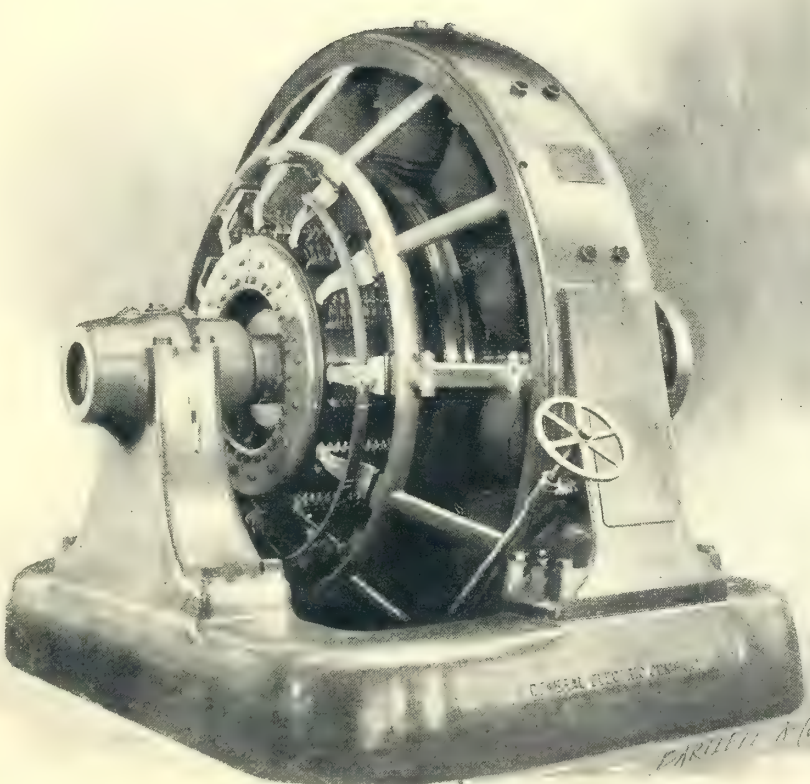


GROUND
RETURN

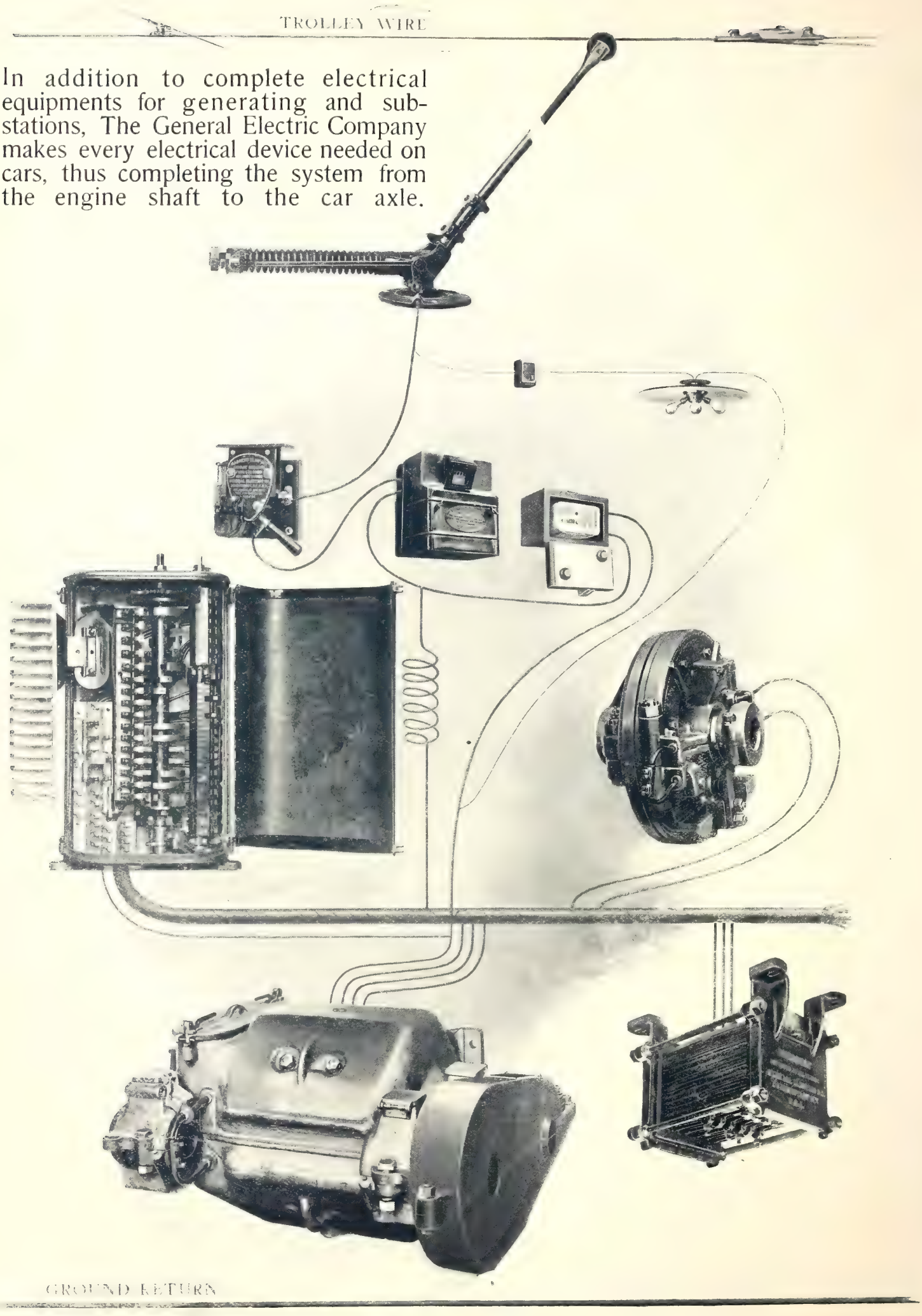
500 VOLT FEEDER TO TROLLEY WIRE



The General Electric Company manufactures also Direct Current Railway Generators and Switchboards.



GROUND RETURN



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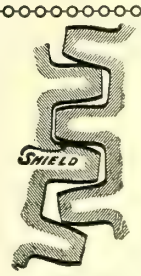

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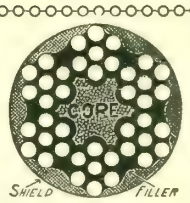

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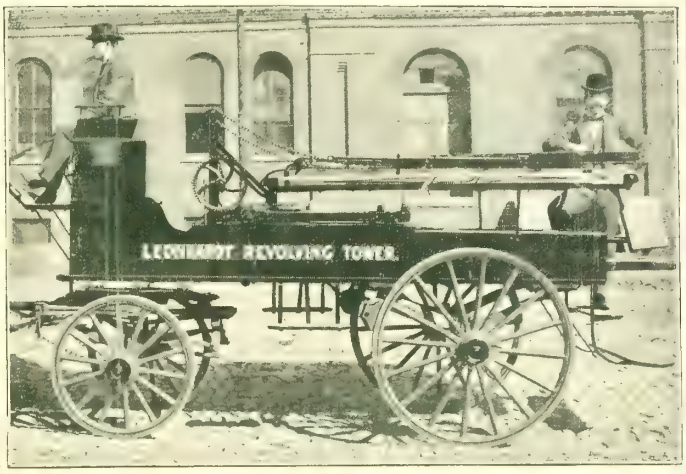

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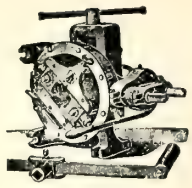

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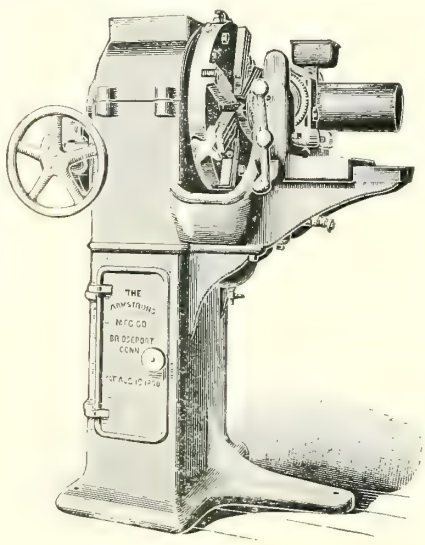

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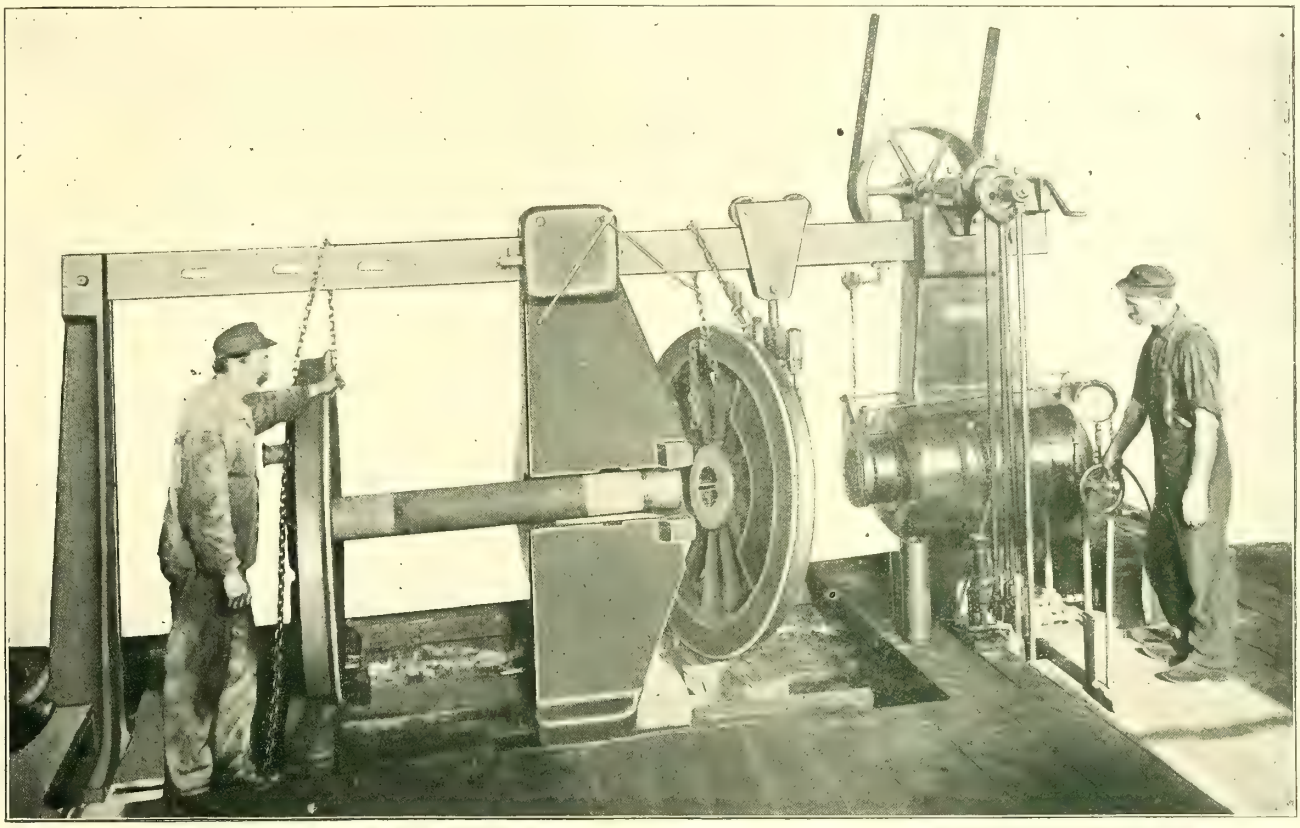

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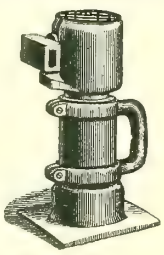

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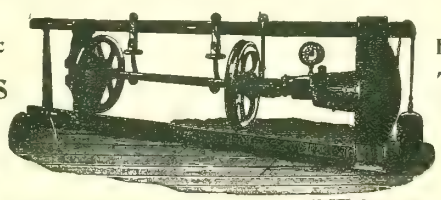

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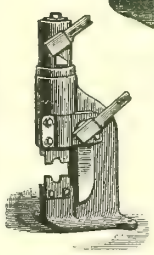

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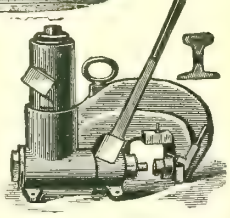

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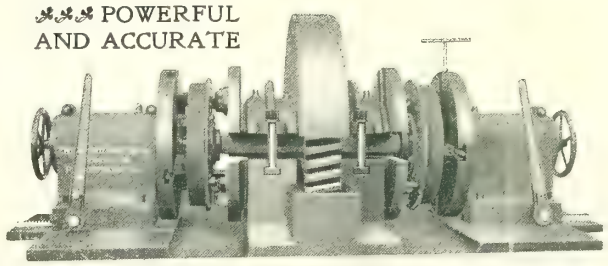

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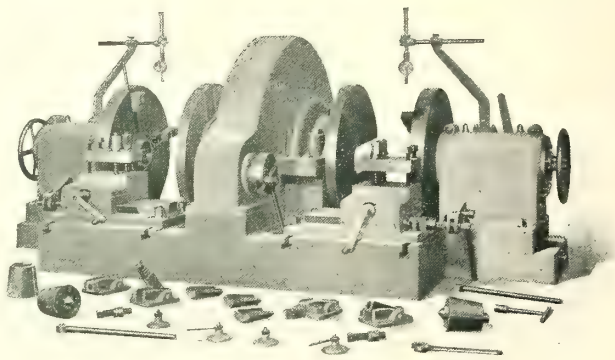

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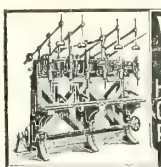

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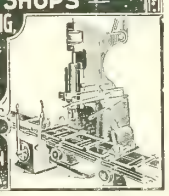

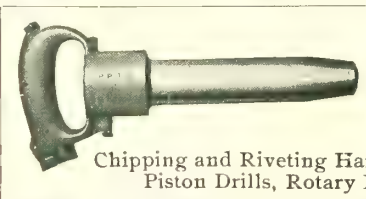

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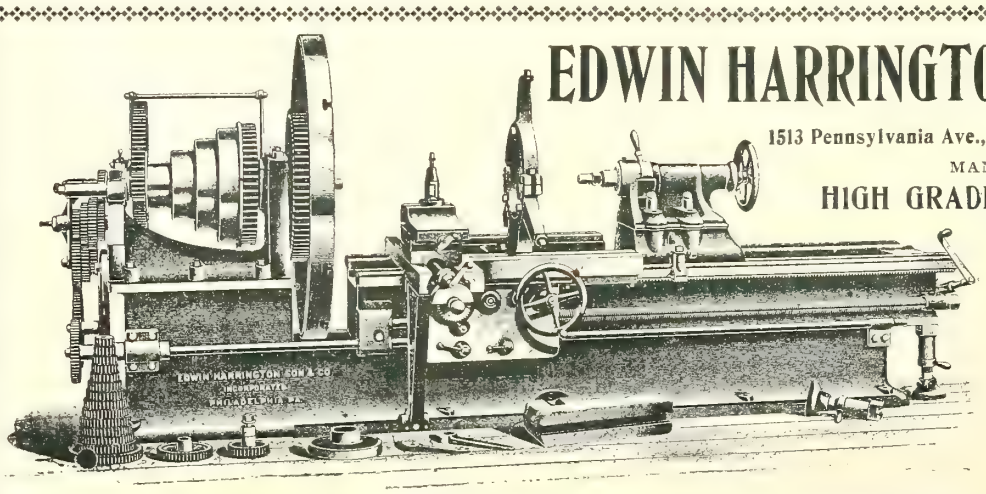

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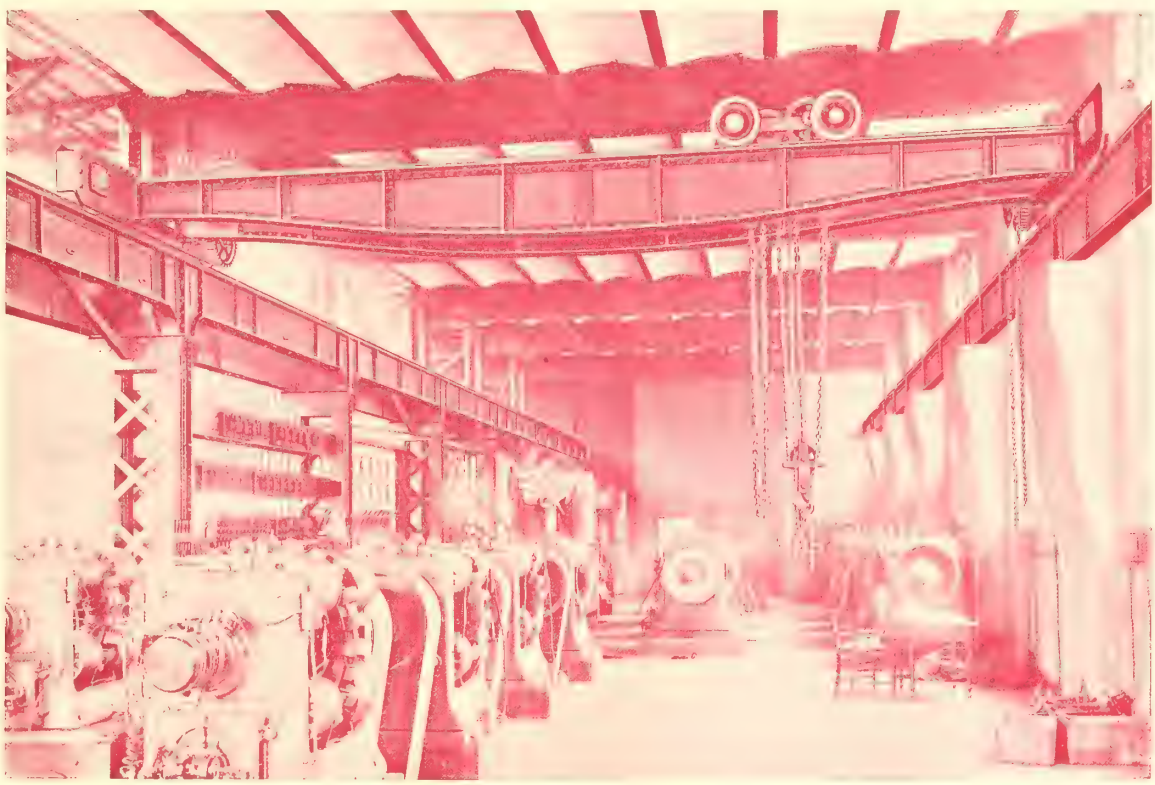

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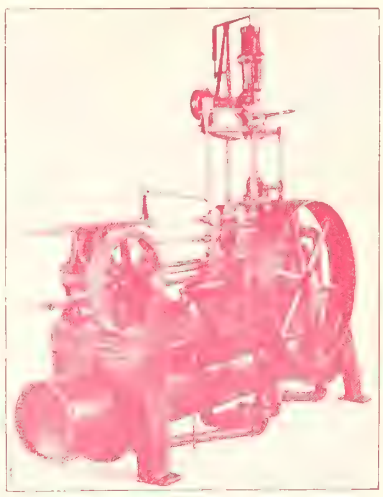

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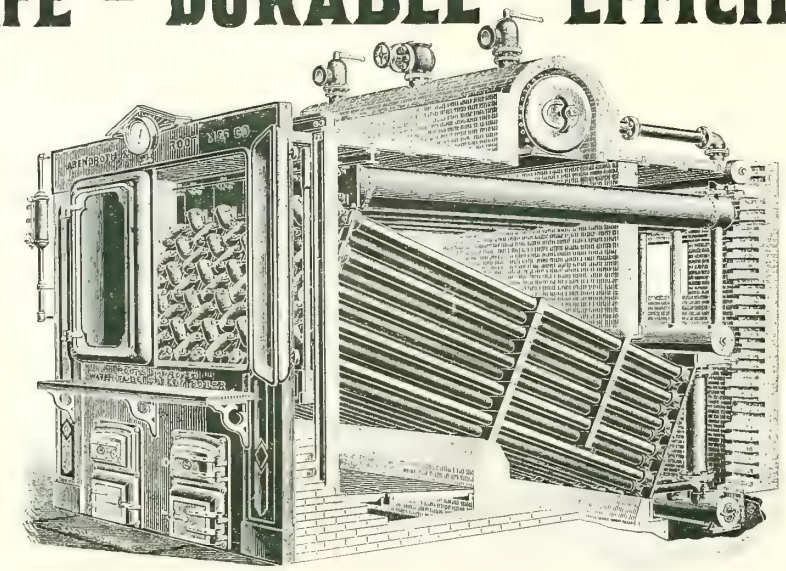

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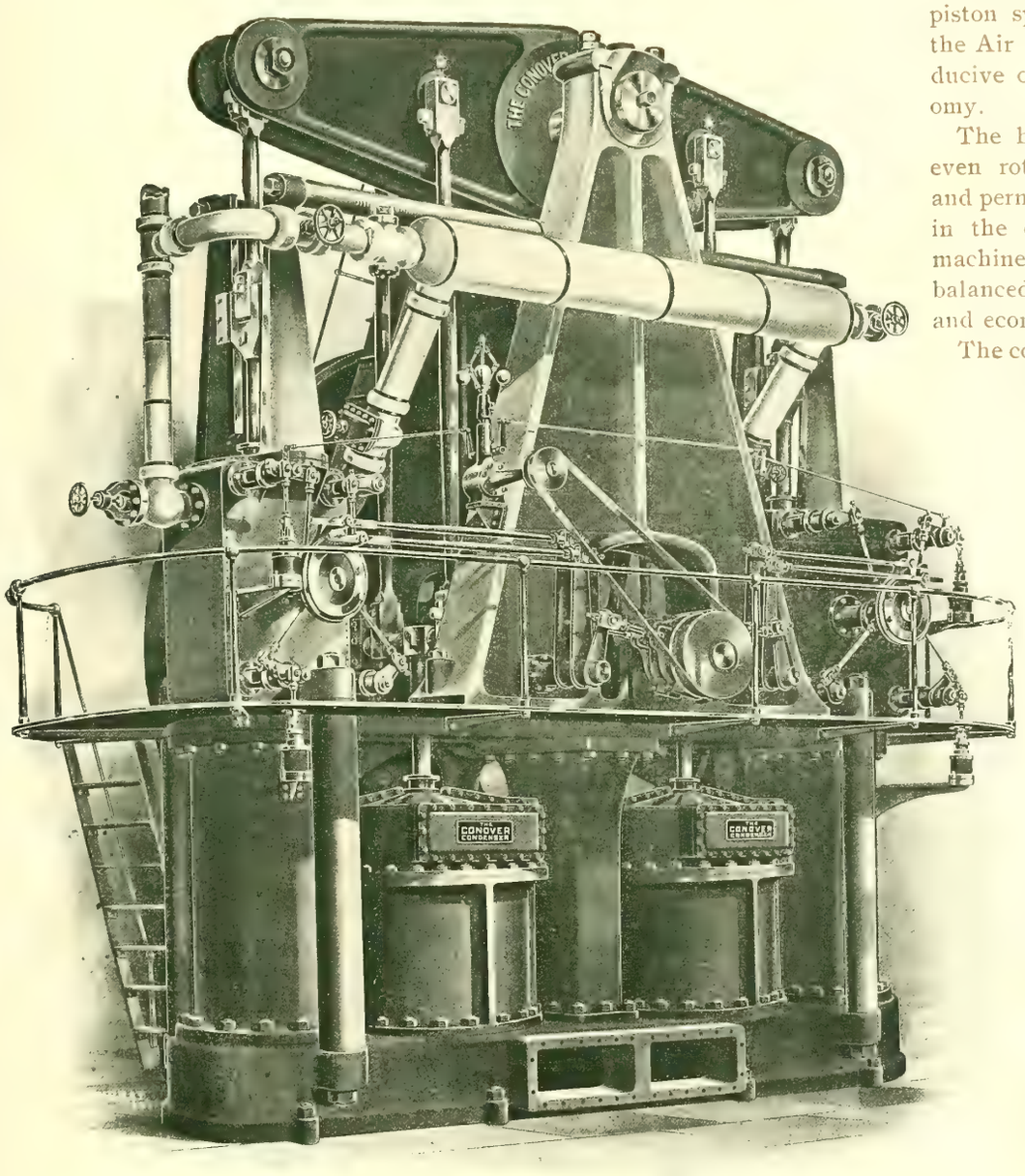
The Air Pumps are mounted one on each side of beam.

The High-Pressure Cylinder is connected to one end of beam, the low pressure to the other end.



CONOVER INDEPENDENT STEAM-DRIVEN CONDENSER—BEAM TYPE
5000 to 20,000 Horse Power

This gives the engine a piston speed of twice that of the Air Pump, which is conducive of the highest economy.

The heavy fly wheel gives even rotation at all speeds, and permits of high expansion in the engine. The entire machine is self-contained, balanced, perfectly accessible, and economical of space.

The construction is massive, and all parts of Condenser will stand the severest duty continuously without the least trouble.

The importance of this style of Condenser is manifest when the fact is taken into consideration that we are able to guarantee a steam consumption of from thirteen to sixteen pounds of dry steam per I. H. P. per hour, according to size, steam pressure, etc.

This design of Condenser is admirably adapted to central condensing plants in large sizes, where its reliable working and high grade economy make a combination not to be equalled.

We believe that our ten years' experience in the *exclusive manufacture of high grade condensing plants* particularly fits us to give very satisfactory results in all cases, and we respectfully offer our services to all who may favor us.

The Conover is the only Condenser sold under a duty guarantee

THE CONOVER MANUFACTURING CO.

26 CORTLANDT ST., NEW YORK

There is only one reason why our system should interest you——

The Saving

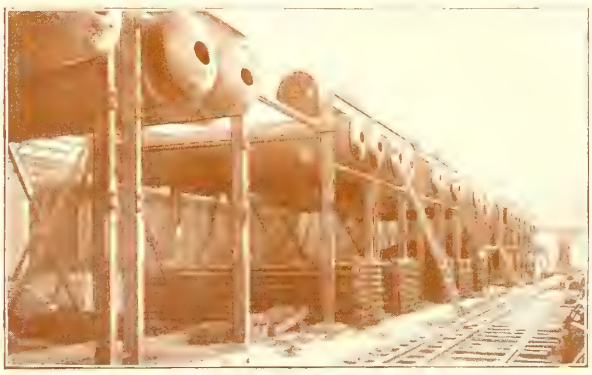
1800 H. P. GREEN'S ECONOMIZER IN COURSE OF ERECTION.

WHAT is obviously impossible when the heating surface is comprised in boilers alone, it being necessary in such case that the gases be not cooled below the temperature of the water circulating in the boilers, is very possible when using a

GREEN'S ECONOMIZER

You can produce steam at a higher temperature than the temperature of the gases when rejected into the chimney. Another saving, 10 to 20 per cent. on fuel; another, larger heating surface, fewer boilers required; another, less breakage in boilers caused by unequal expansion and contraction; another, feed water heated to 250 degrees.

We equip plants from 100 to 36,000 H. P. Equally valuable, whether for electric traction or electrical supply



GREEN'S ECONOMIZERS AND BOILERS IN COURSE OF ERECTION.

BOOK "GREEN'S ECONOMIZER" FREE

The Green Fuel Economizer Co.

MATTEAWAN, N. Y.

Sole Manufacturers in the United States

New York Office, 74 CORTLANDT STREET

Chicago Office, 1105 MONADNOCK BLOCK

THIS PAGE ENGRAVED BY THE PENNSYLVANIA ENGRAVING CO., DETROIT, MICH.

HIGH .. PRESSURE PIPING

FOR

POWER PLANTS OF EVERY DESCRIPTION

MANUFACTURERS OF

PIPE BENDS

IN ANY PRACTICAL SHAPE

Flanged Fittings and Flanges

W. K. MITCHELL & CO.

Engineers and Contractors

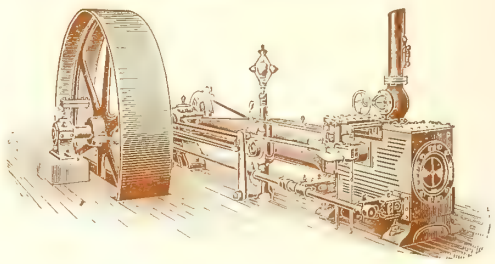
OFFICES, BETZ BUILDING

PHILADELPHIA, U. S. A.

Providence Engineering Works

PROVIDENCE, R. I.

Successors to PROVIDENCE STEAM ENGINE CO.
Also to RICE & SARGENT ENGINE CO. for U.S.A.



SOLE BUILDERS OF THE

RICE & SARGENT ENGINES....

AND

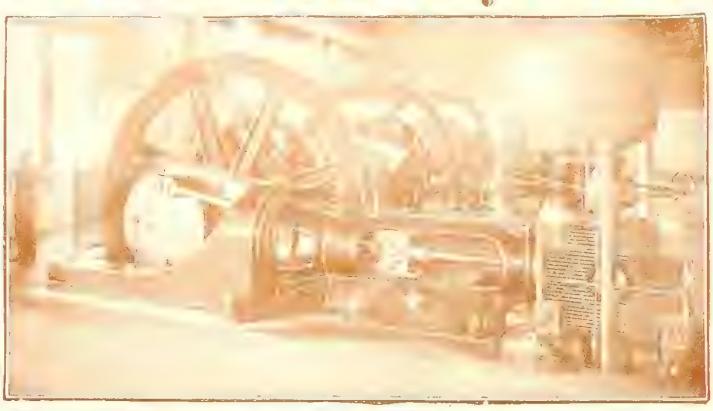
IMPROVED GREENE ENGINES

THE GREENE ENGINE was the first to successfully handle **Heavy Electric Lighting** and **Power** work, and it still maintains its early reputation.

It is largely used where coal is expensive and **Economy of Operation is the First Consideration.**

It is likewise largely used where the **Closest Regulation** is a **Necessity.**

ST. LOUIS CORLISS ENGINE



Special Heavy Duty Engines for Electric Railways, Rolling Mills, etc.,

For Direct Connecting or Belting, Simple or Compound.

Complete Plants Designed, Built and Installed.

BUILDERS:

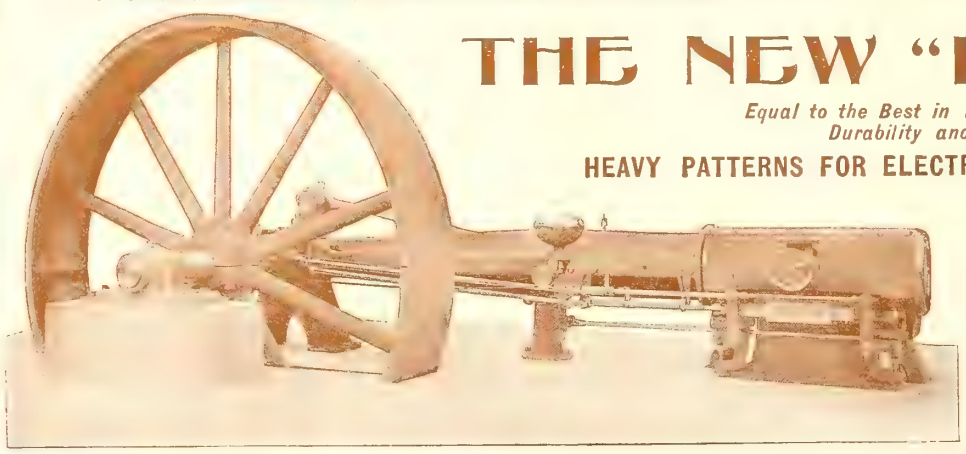
St. Louis Iron & Machine Works,

ST. LOUIS, MO.

EASTERN AND FOREIGN SALES DEPARTMENT:

Frank M. Pierce Engineering Co.,

26 CORTLANDT ST., NEW YORK.



THE NEW "BROWN"

Equal to the Best in Economy, Durability and Close Regulation,

HEAVY PATTERNS FOR ELECTRIC STREET RAILWAY WORK

Simple, Condensing and Compound ...

EXCLUSIVE MANUFACTURERS

C. H. BROWN & CO.

16 Main St., Fitchburg, Mass.

NEW YORK MANAGERS
WOOLSTON & BREW
141 BROADWAY

The BALL & WOOD CO.

120 Liberty Street
New York, U. S. A.

CABLE ADDRESS:
BALLWOOD
NEW YORK

London Office:
97 Queen Victoria Street

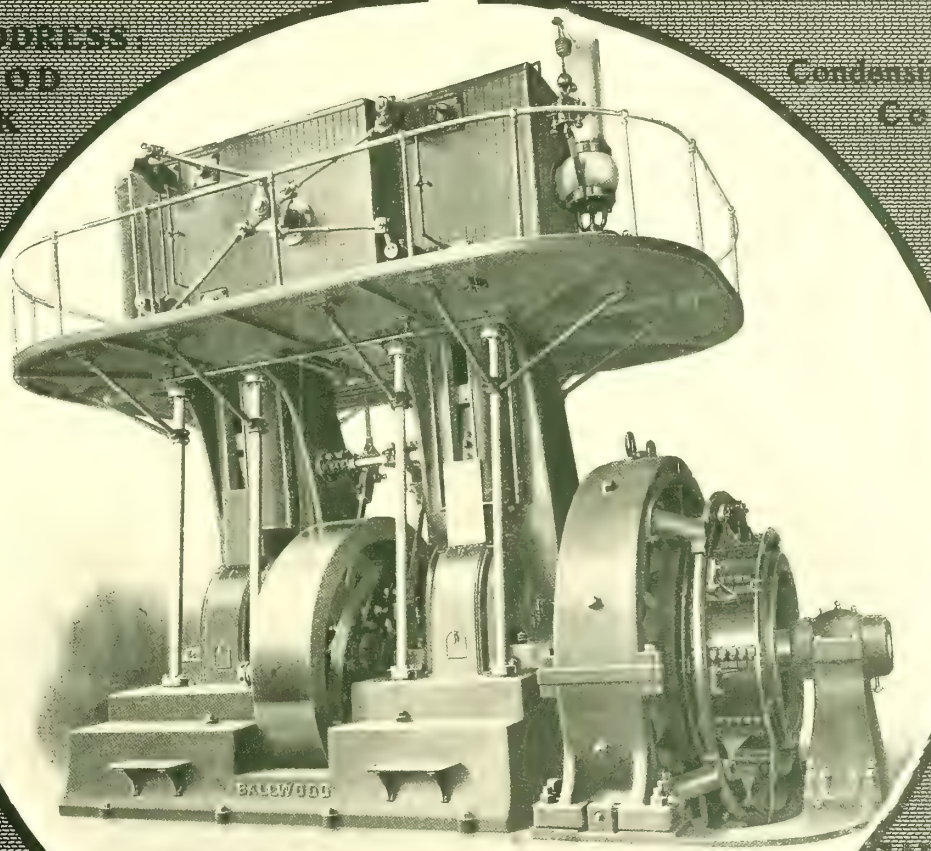
Automatic Cut Off Steam Engines

ESPECIALLY DESIGNED FOR RAILWAY AND LIGHTING SERVICE

Simple or Compound

Condensing or Non-Condensing

Belted or Direct Connected



Excellent Design and Superior Workmanship, Simplicity of Construction and Silence in Operation are distinguishing characteristics of Ball & Wood Engines

Under Actual Working Conditions they are outranking the Corliss in

REGULATION
ECONOMY AND
EFFICIENCY

ORIGINAL GEO. H. CORLISS,
IMITATED BY ALL THE WORLD,
BUT NOT EXCELLED.

GREENE-WHEELOCK,
HOLDING WORLD'S RECORD
FOR PRACTICAL ECONOMY.

STEAM ENGINES

INTERNATIONAL POWER COMPANY,

OPERATING CORLISS STEAM ENGINE COMPANY.

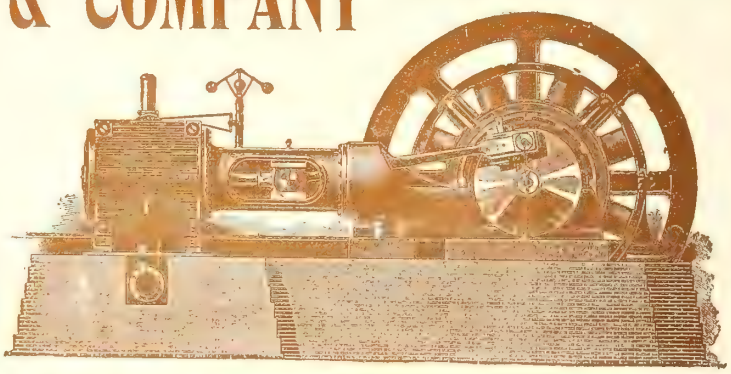
PROVIDENCE, R. I., U. S. A.

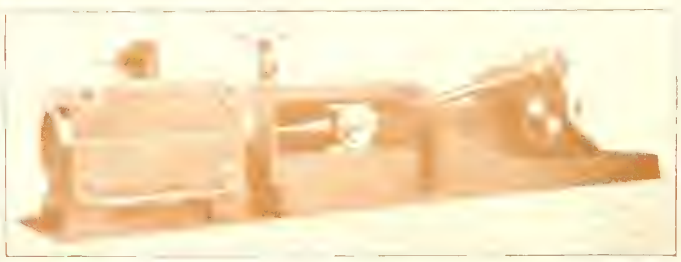
ROBT. WETHERILL & COMPANY OFFICE AND WORKS **CHESTER, PA.**

Electric Railway
Power Plants ...

POWER · MACHINERY

CORLISS ENGINES — *BERRY BOILERS*

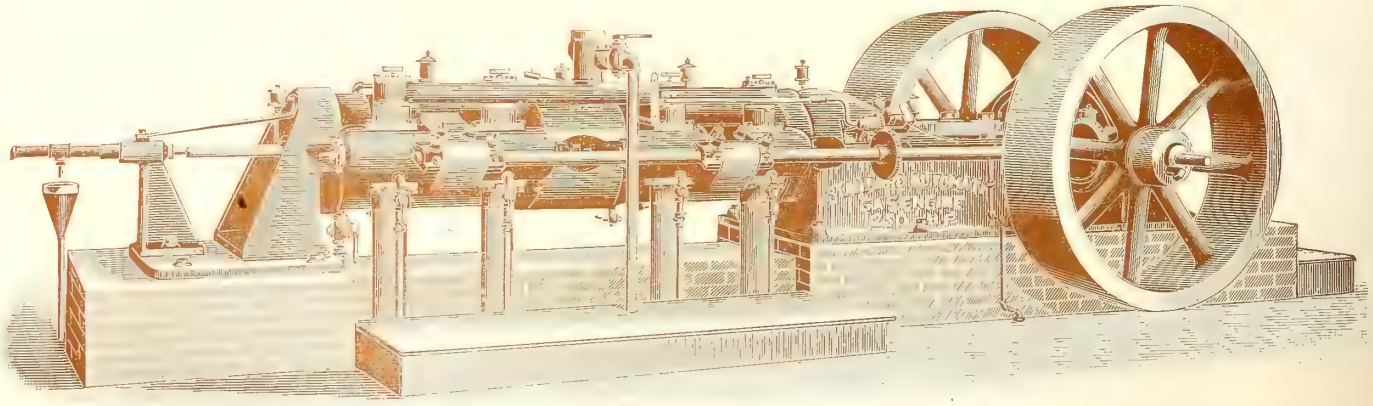




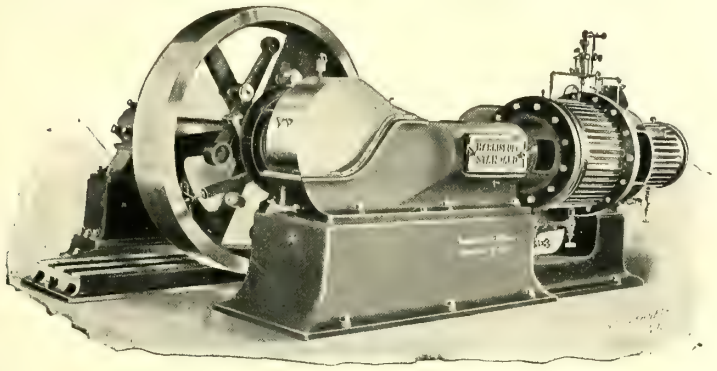
THE **FILER & STOWELL CO.,**
MILWAUKEE, WIS.
HEAVY DUTY CORLISS ENGINES.
Best Design *Best Efficiency.* *Best Workmanship*
CONDENSERS
COMPRESSORS
PUMPING MACHINERY
POWER TRANSMISSIONS
Eastern Representative, THEO. W. PHILLIPS, 4 Market Square, Providence, R. I.

STANDARD AUTOMATIC GAS ENGINE CO.,
SALES DEP'T: YOUNGSTOWN, OHIO.

One of our 200 H. P. Engines is operating eight miles of street car service in Oil City, Pa., showing the highest efficiency and economy ever recorded.



Our Double Acting Tandem Gas Engines take TWO impulses each revolution.
Built in sizes of 100 H.P., 160 H.P., 200 H.P., 350 H.P., 500 H.P., and 1000 H.P.
Government equal to the best high-grade steam engine. Inspection invited.



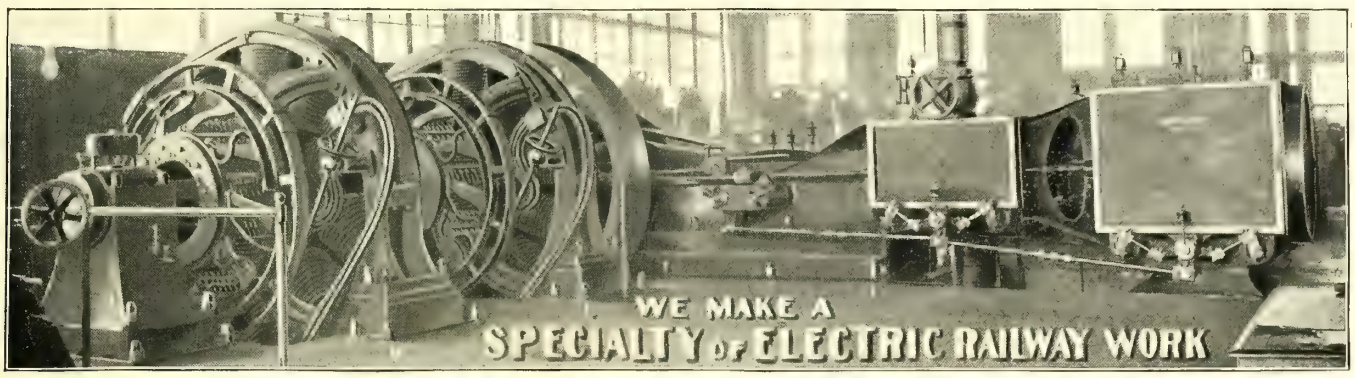
HARRISBURG STANDARD TANDEM COMPOUND ENGINE
DIRECT CONNECTED STYLE

Harrisburg Engines

6 TO 3,000 HORSE POWER HIGH SPEED
MEDIUM SPEED AND CORLISS

Harrisburg Foundry and Machine Works
HARRISBURG, PA., U. S. A.

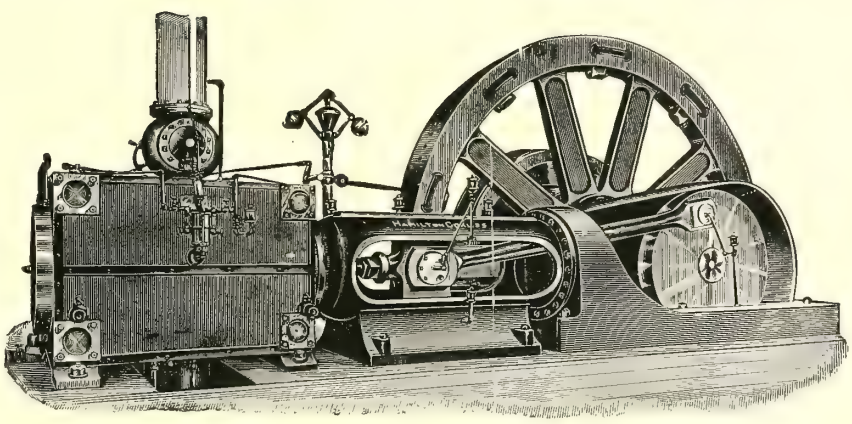
THE RUSSELL ENGINE CO., Massillon, Ohio, U. S. A.



Simple and Compound. BUILDERS OF ENGINES OF THE SINGLE AND FOUR VALVE PATTERNS. Belted and Direct Connected.

HAMILTON CORLISS ENGINES

OVER 1,200 IN DAILY USE



Over 200 in Street Railway Service

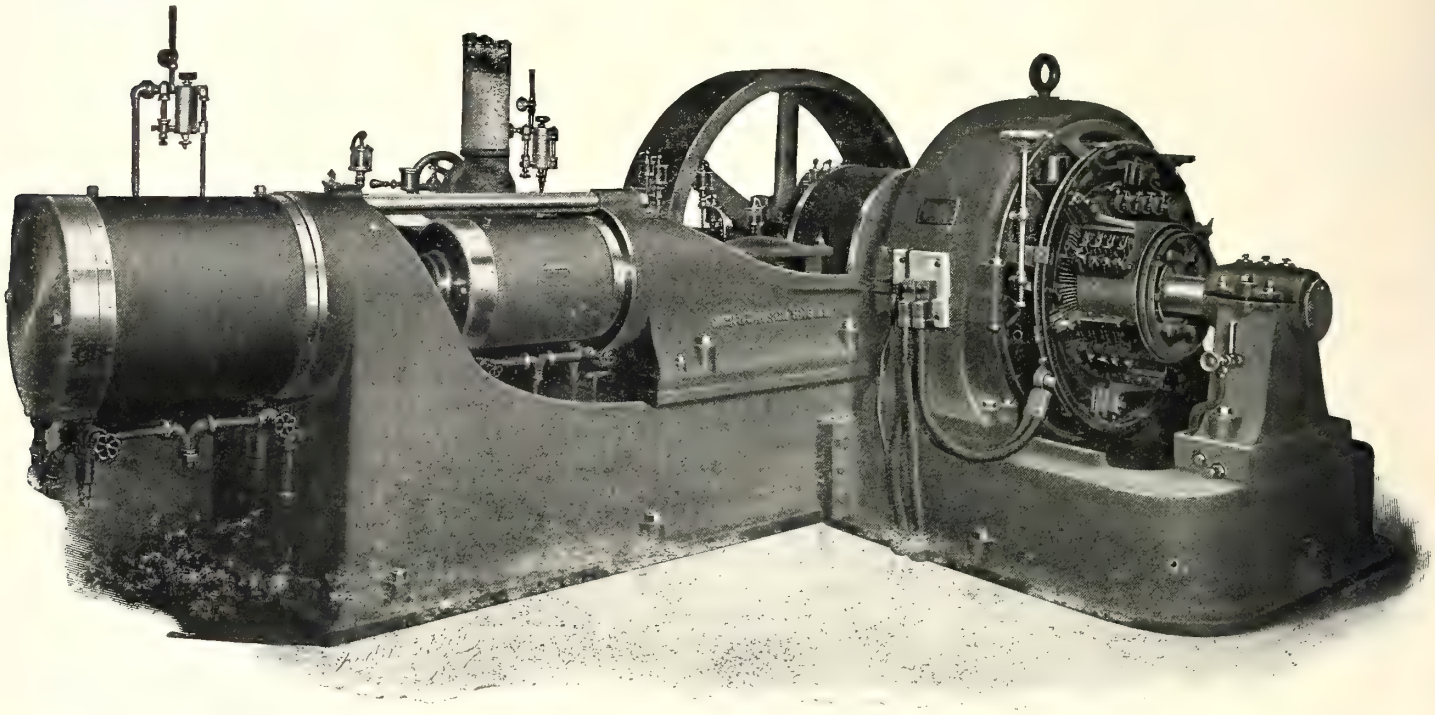
Following are a few of the Principal Lines having our Engines in use:

Denver Tramway Co., Denver, Col.
Pittsburgh & Birmingham Traction Co., Pittsburgh, Pa.
Missouri R. R. Co., St. Louis, Mo.
St. Louis & Suburban R. R. Co., St. Louis, Mo.
Union Depot R. R. Co., St. Louis, Mo.
Consolidated Street Railway Co., Cincinnati, Ohio
Naumkeag Street Railway Co., Salem, Mass.
Wichita Electric R. R. Co., Wichita, Kans.
City Electric Railway Co., Little Rock, Ark.
Quincy Horse Railway & Carrying Co., Quincy, Ill.
Toledo Consolidated Street Railway Co., Toledo, Ohio.

THE HOOVEN, OWENS & RENTSCHLER CO., HAMILTON, OHIO

PHOENIX IRON WORKS COMPANY

BUILDERS "Dick & Church" Automatic Cut-Off Engines



Complete Power Plants a Specialty

MAIN OFFICE AND WORKS: MEADVILLE, PENN.

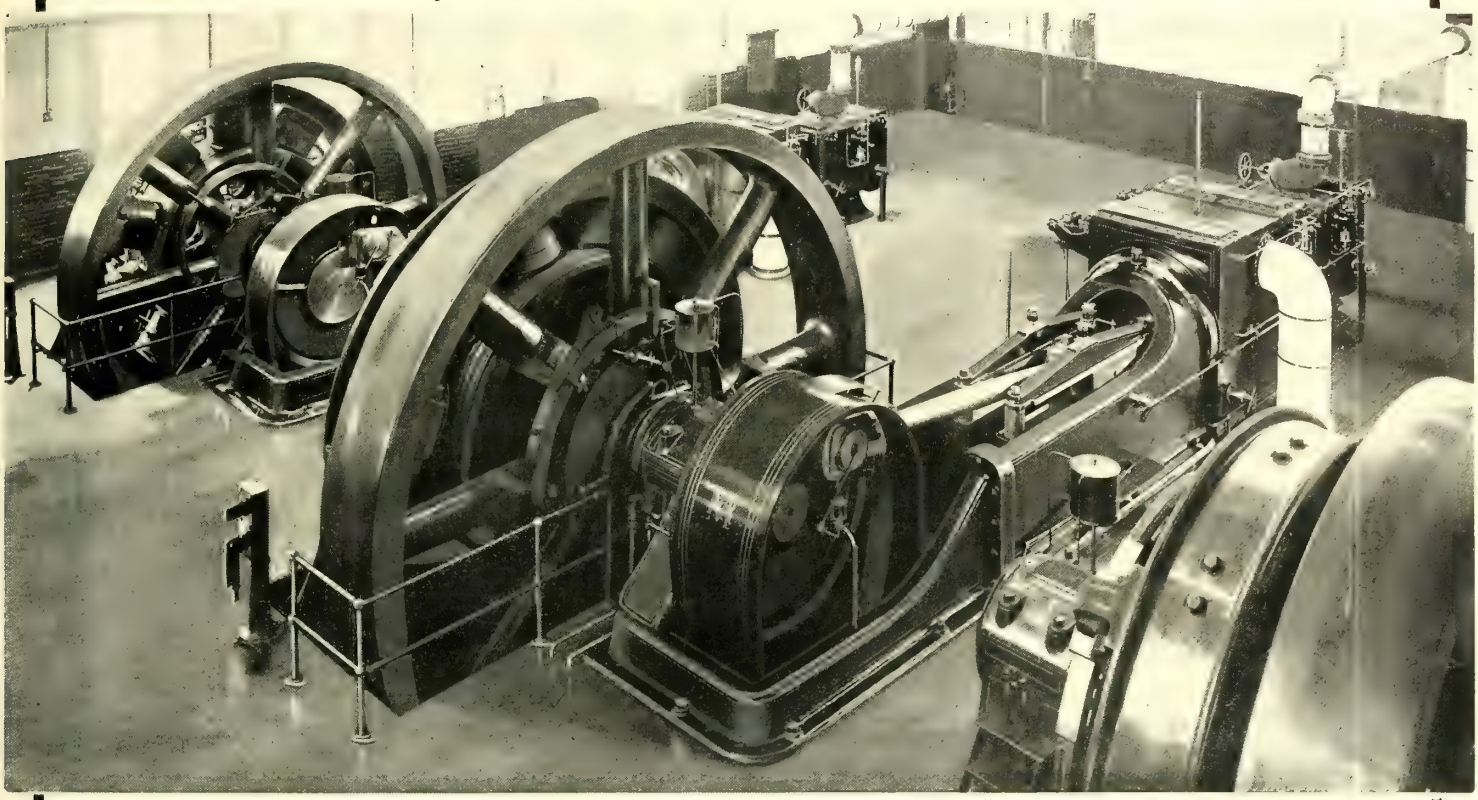
NEW YORK: 15 CORTLANDT ST. CHICAGO: WESTERN UNION BLDG. BOSTON: 185 FRANKLIN ST. PITTSBURG: 403 FURGESON BLDG.

RIDGWAY DYNAMO & ENGINE CO., RIDGWAY, PA.

POWER PLANT OF BUCKS COUNTY STREET RAILWAY, NESHAMINY, PA.

THOMPSON-RYAN DYNAMOS. McEWEN AUTOMATIC ENGINES.

McINTOSH, SEYMOUR & CO., Auburn, N. Y.



ALL SIZES AND TYPES. **SPECIAL ENGINES TO MEET REQUIREMENTS.**

New York
McINTOSH, SEYMOUR & CO.
26 Cortlandt Street

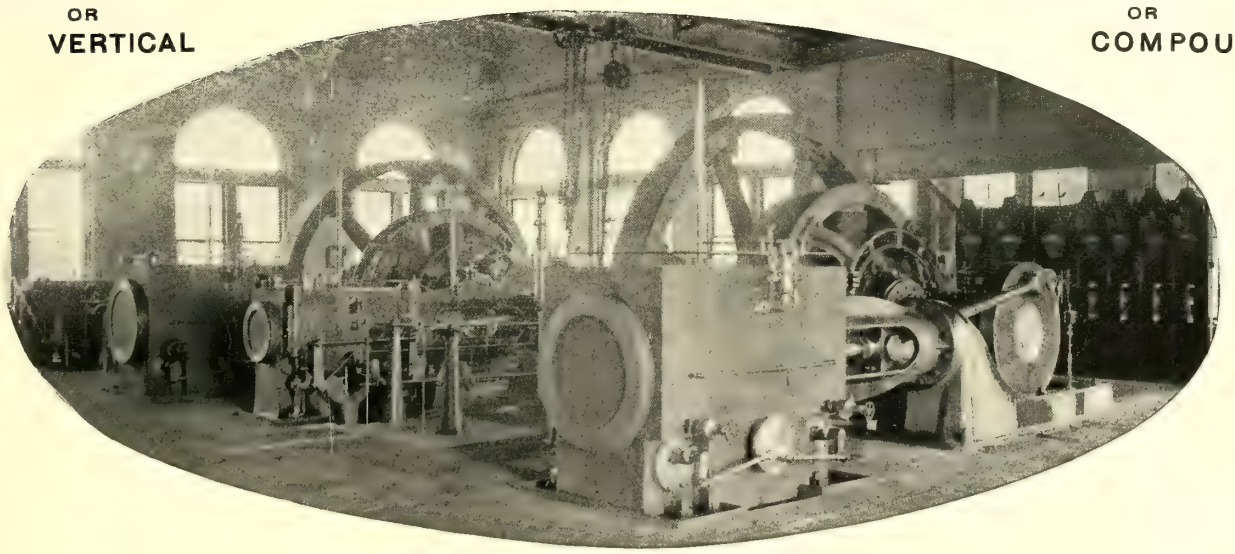
Boston
J. A. GRANT & CO.
8 Oliver Street

San Francisco
C. C. MOORE & CO.
32 First Street

THE SLATER ENGINE

HORIZONTAL OR VERTICAL

SIMPLE OR COMPOUND



POWER STATION LEXINGTON AND BOSTON STREET RAILWAY

...OUR LATEST INSTALLATIONS

LEXINGTON & BOSTON ST. RY. CO., 2 Cross Compounds
GEORGETOWN, ROWLEY & IPSWICH ELEC. RY., 2 Cross Compounds
GARDNER, WESTMINSTER & FITCHBURG ST RY., 2 Cross Compounds
PALMER & MONSON ST. RY. CO., 1 Cross Compound
DAYTON, SPRINGFIELD & URBANA ELEC. RY., 3 Cross Compounds
OHIO CENTRAL TRACTION CO., 2 High Duty
RHODE ISLAND SUB. RY., 2 Cross Compounds
READING & BOSTON ST. RY. CO., Ordered

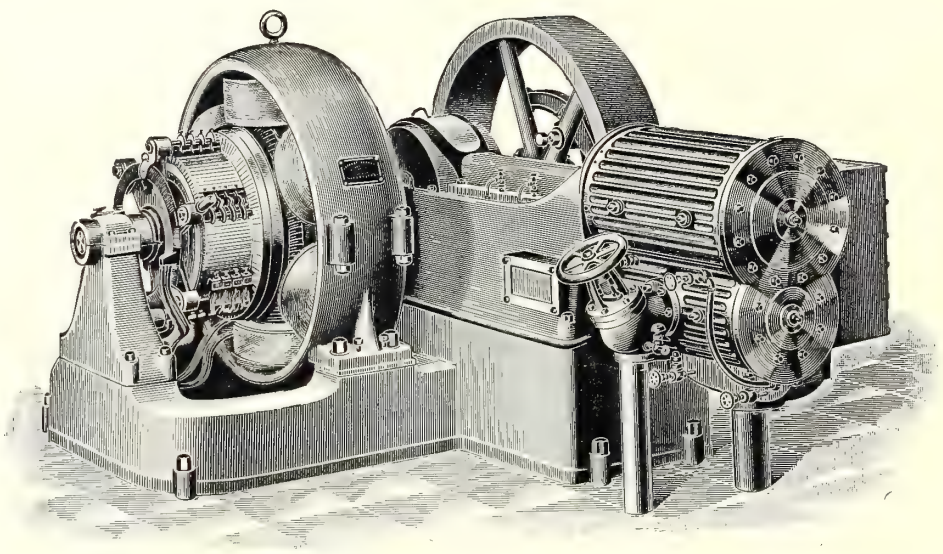
BOSTON OFFICE
53 STATE ST.

THE SLATER ENGINE CO., WARREN, MASS., U. S. A.

American-Ball...

Duplex Compound Engine

and Direct-Connected Generator



A Compound Engine specially adapted to non-condensing railway service.

A clear saving of 25 per cent. in fuel without the condenser, and nearly 50 per cent. with the condenser.

Requires no more floor space than a simple engine, no more cost of attendance or repairs.

We furnish complete direct-connected plants, both engine and generator of our own manufacture.

AMERICAN ENGINE CO.

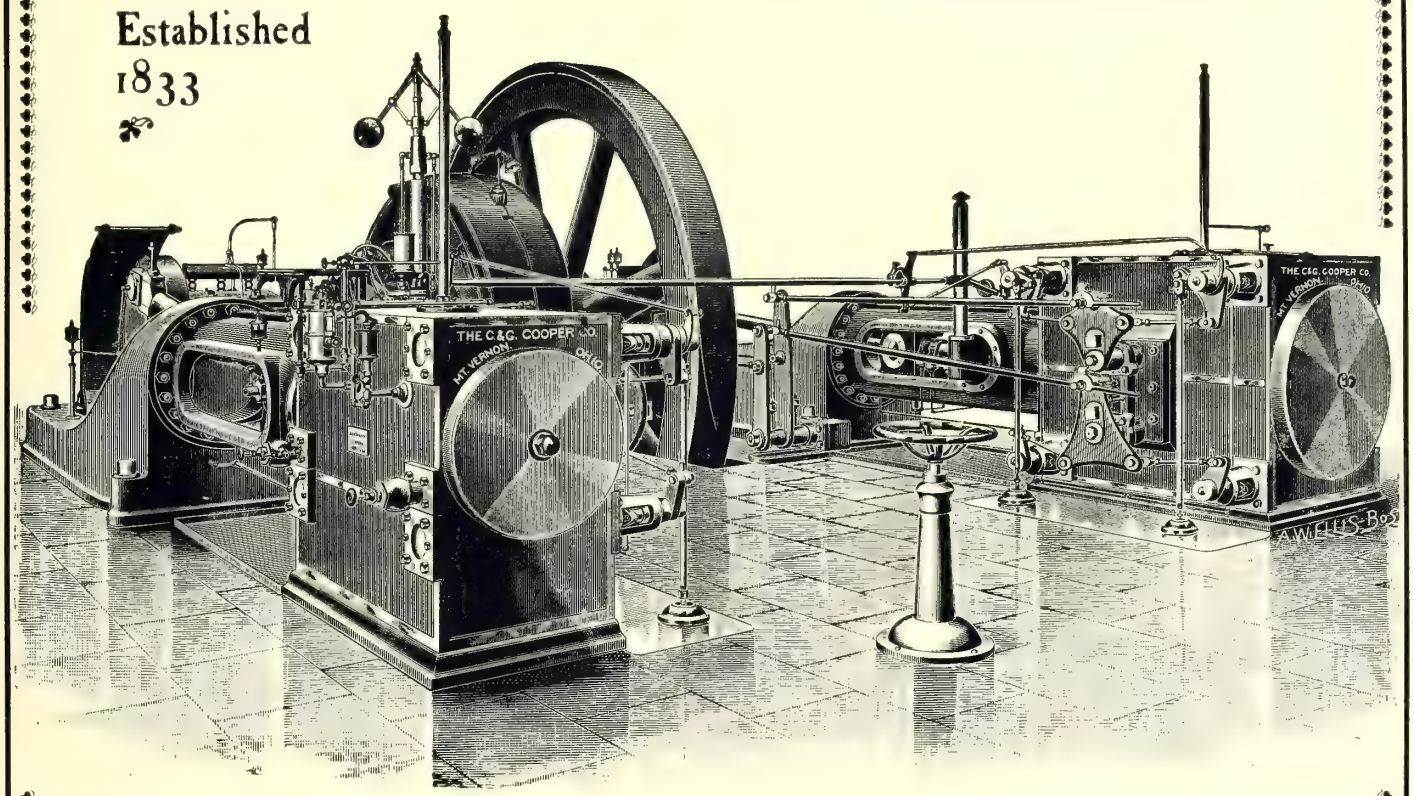
BOUND BROOK, N. J.

New York Office: 95 Liberty Street.

The C. & G. COOPER CO.

....MT. VERNON, OHIO.

Established 1833



BUILDERS .....OF Corliss Engines

COMPOUND, CONDENSING AND HIGH PRESSURE

OVER 50,000 HORSE POWER OPERATING ELECTRIC RAILWAYS

WE make a specialty of Direct Coupled Work and of equipping the largest Power Plants. Engines of 150 to 2500 H. P. for direct-connected Generators. Simple or Compound. Particular Attention given to the Export Trade. Write for specifications and estimates.

ADDRESS AS ABOVE

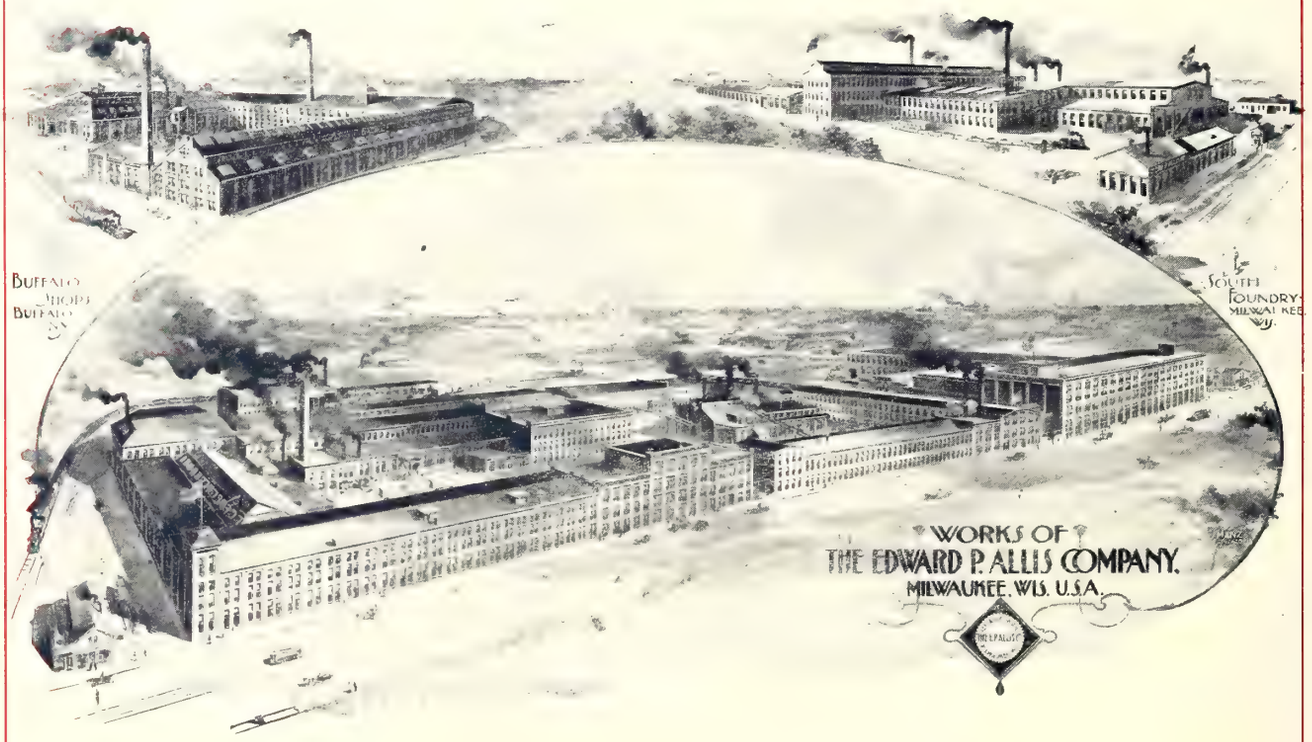
RELIANCE WORKS THE E.P. ALLIS CO MILWAUKEE, WIS.

THE EDWARD P. ALLIS COMP'Y

MILWAUKEE, WIS.

Branch Offices and Agencies

NEW YORK CHICAGO PITTSBURG MINNEAPOLIS BUTTE DENVER
SPOKANE SEATTLE SAN FRANCISCO CITY OF MEXICO
LONDON PARIS SANTIAGO, CHILI JOHANNESBURG, SOUTH AFRICA



Our Engines are driving Electric Roads in

NEW YORK CITY	CHICAGO	BROOKLYN	PHILADELPHIA
MILWAUKEE	DETROIT	BOSTON	WASHINGTON
PROVIDENCE	ALBANY	ST. LOUIS	PORTLAND, ME.
CLEVELAND	LOUISVILLE	KANSAS CITY	LOS ANGELES
NEW ORLEANS	MINNEAPOLIS	HOUSTON	BALTIMORE
LONDON, ENG.	MIDDLESBORO, ENG.	DUBLIN, IRELAND	SYDNEY, AUST.
MADRID, SPAIN	BARCELONA, SPAIN	BUENOS AYRES, ARGENTINE REP.	

RELIANCE WORKS THE E.P. ALLIS CO MILWAUKEE, WIS.
RELIANCE WORKS THE E.P. ALLIS CO MILWAUKEE, WIS.
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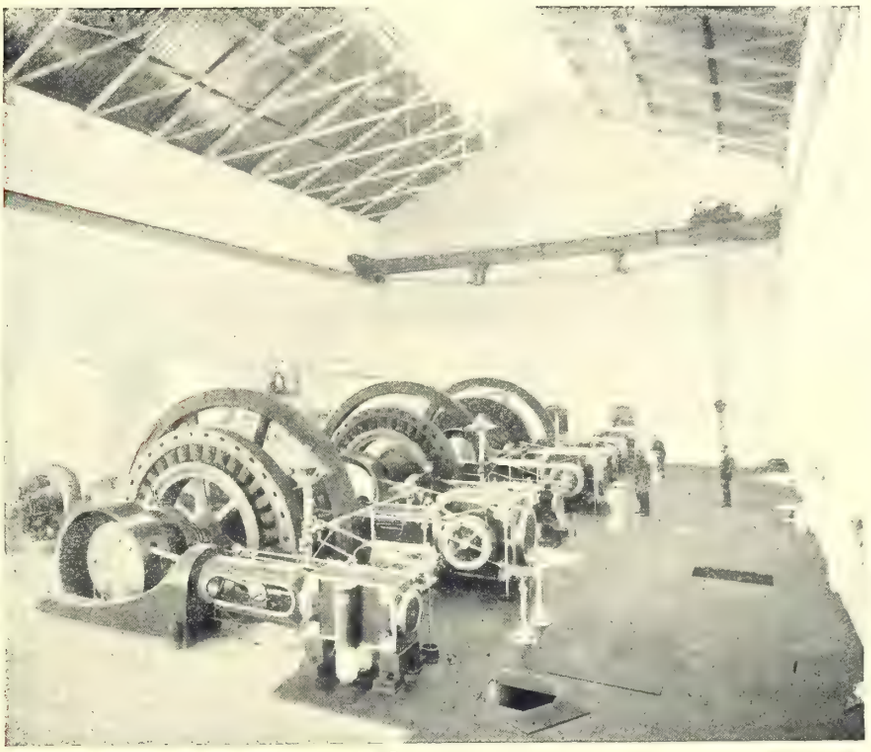
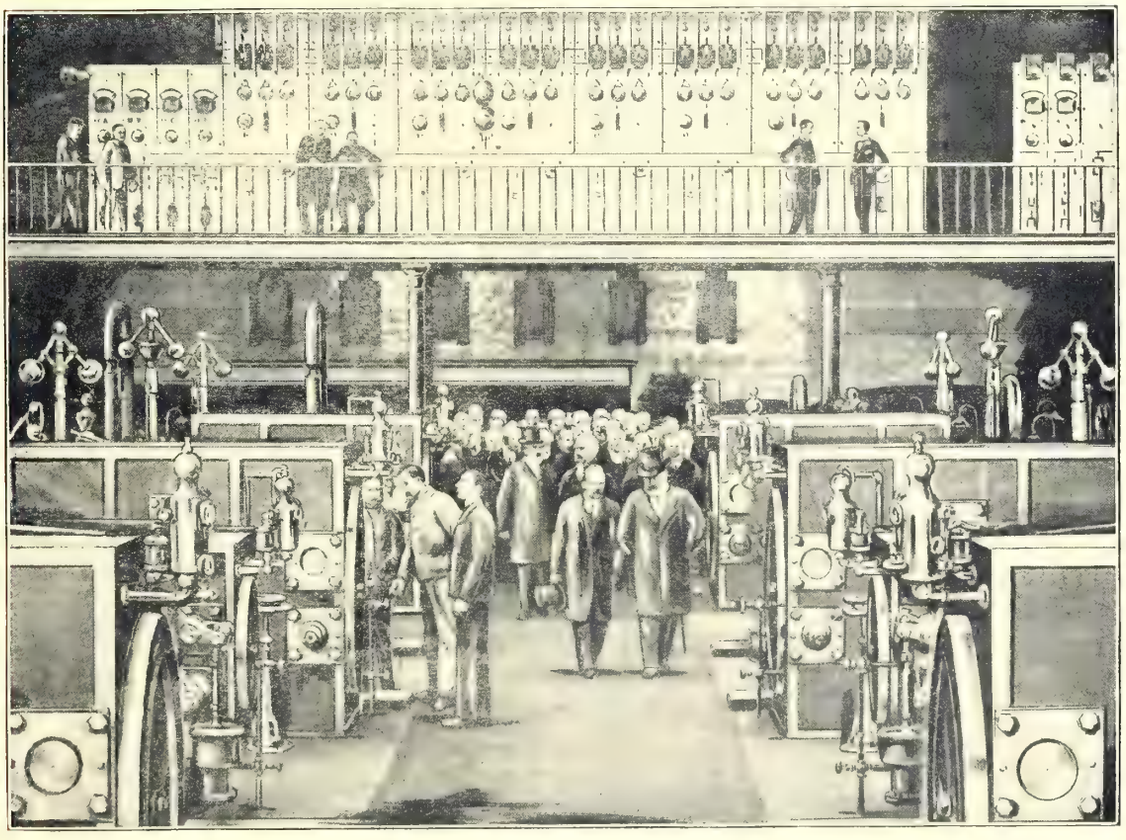
RELIANCE WORKS THE E.P. ALLIS CO. MILWAUKEE, WIS.

THE EDWARD P. ALLIS CO. MILWAUKEE WIS., U. S. A.

Power Station of Middlesboro' Tramways, Middlesboro', England.



Three Engines, 16-32 x 36 Horizontal Cross Compound



Power Station of Central London Underground Railway, London, England.

Six Engines, 24-46 x 48 Horizontal Cross Compound.

Photograph taken on opening day, showing the Prince of Wales and Sir Benjamin Baker in the foreground, coming down the aisle.

RELIANCE WORKS THE E.P. ALLIS CO. MILWAUKEE, WIS.

AMERICAN ECONOMIZER

(BURPEE'S PATENTS)
(BROOMELL'S PATENTS)

FOR HEATING AND PURIFYING FEED WATER FOR STEAM BOILERS BY UTILIZING THE HEAT IN FLUE GASES

IF AN **American Economizer** is installed in your boiler plant, the results will be highly satisfactory for the following reasons:

1st. There will be an actual and genuine saving of fuel of from 10 to 25 per cent, which would otherwise be lost entirely.

2nd. There will be an increase in the capacity of your boiler plant, oftentimes sufficient to save investment in additional boilers.

3rd. There will be a great saving in the matter of boiler repairs, because the very hot water freed from impurities fed to the boiler prevents unequal expansion and accumulation of mud and scale.

4th. There will be less necessity to renew boilers, their lives being prolonged for the reasons given above.

5th. There will be less necessity to shut down for cleaning boilers, because the impurities contained in the feed water are precipitated in the Economizer in place of the boiler. The slow movement of water through the Economizer gives the time required to accomplish this result.

6th. There will be a great improvement in the matter of steam pressure because of the large amount of very hot water contained in the Economizer, which is always ready to draw on in case of a sudden call for steam.

7th. There are very many uses for hot water in manufacturing plants other than for feeding boilers. Packing houses use the water for many purposes; sugar refineries find continued calls for large quantities of hot water; dye houses and bleachers use hot water continually. Mills or factories can be heated by the circulation of hot water drawn from Economizers without any cost whatever.

TEMPERATURE AFTER LEAVING ECONOMIZER 300 DEGS.
THE GASES AS THEY ARE NOT ALL GOING OUT OF THIS STACK
The American Fuel Economizer
MANUFACTURED BY
Broomell, Schmidt & Co., LIMITED.
York, Penna. U.S.A.
FROM BOILERS
TEMPERATURE
700 DEGS.

Mechanical Draft...

THE ideal steam plant of the future will be arranged on the induced draft system. The smoke fans will be built in the best possible manner and of ample capacity to handle the gases at a very low rate of speed. The engines attached to these fans will be strong and heavy, arranged to use steam in the most economical manner, and will be automatically regulated to the draft required.

American Fuel Economizers of ample proportions will be installed between the boilers and the smoke fans. These Economizers will be enclosed in the most approved style of sectional metallic casing.

The boilers will be equipped with the latest pattern of mechanical stokers and smokeless furnaces, the whole making a complete and satisfactory plant which will produce steam at a cost below that on any other system.

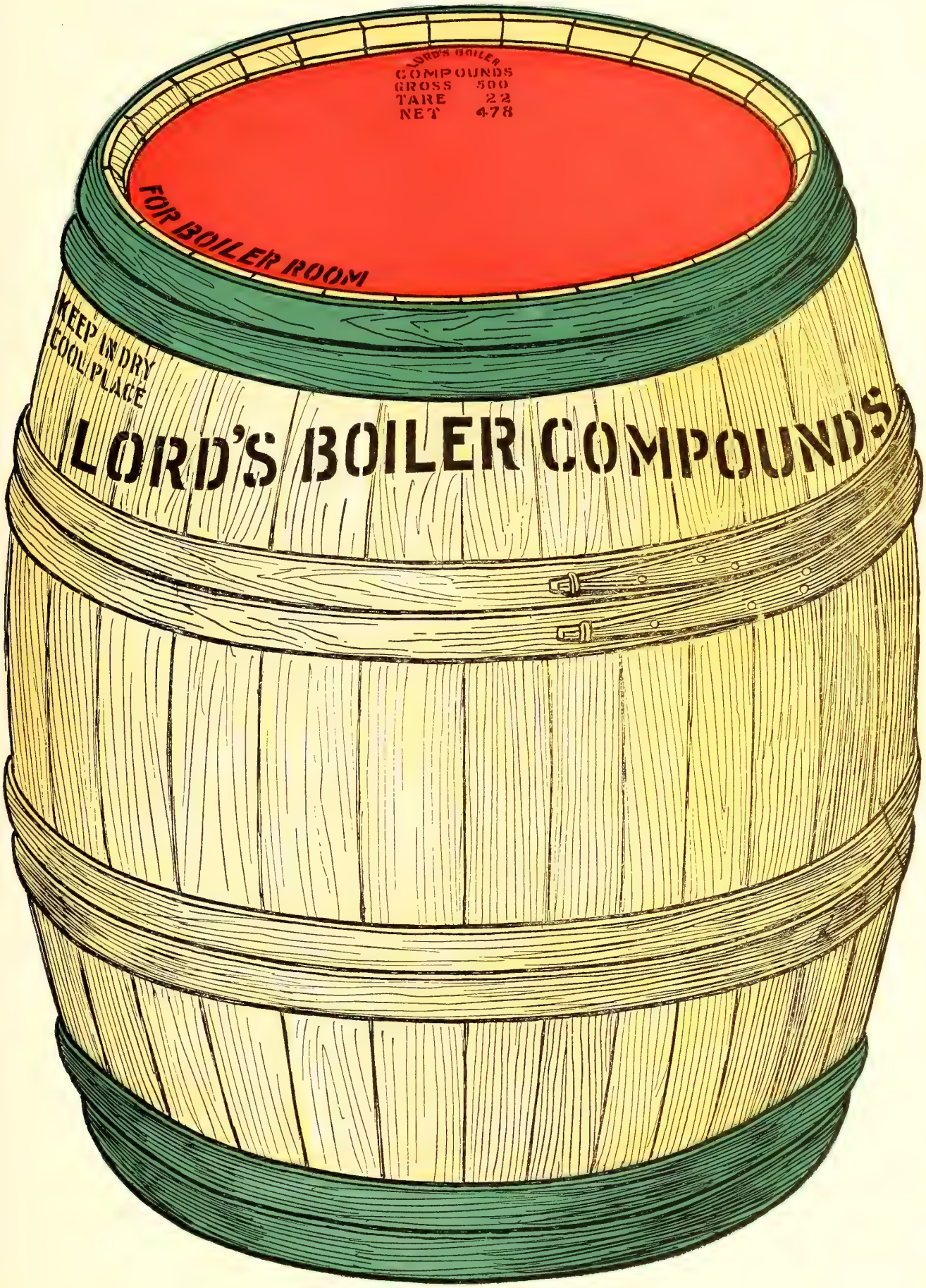
We are prepared to install induced draft systems and to guarantee all the above desirable results. We build our own engines and smoke fans, which are carefully designed and built in the very best possible manner from heavy steel plates strongly braced with angle and T irons.

We also recommend induced draft fans of very ample proportions. Mistakes that have been made on this system all come from using badly designed fans of entirely inadequate proportions.

Send full particulars, and will be glad to make plans and specifications.

BROOMELL, SCHMIDT & CO., Limited

YORK, PA., U. S. A.



The Genuine Lord's Boiler Compounds are prepared specially as per the requirements of each customer, and are shipped in barrels painted and stenciled like the above fac-simile.

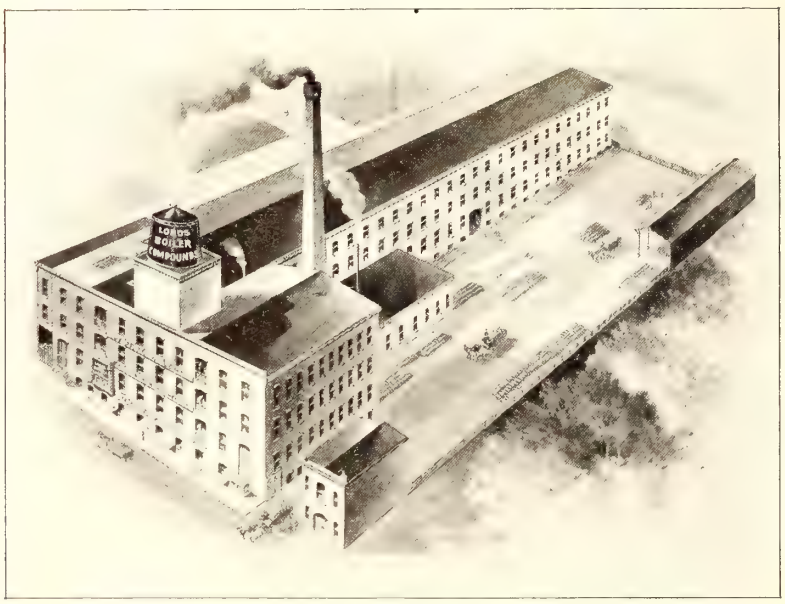
Facts and Proof

Facts.

Established in 1865.

First maker of Boiler Compounds in the United States.

Largest and best equipped Water Purifying Chemical Factory in the world.



OFFICE AND LABORATORY.

Supplying a larger number of Street Railway Power Plants than all other Boiler Compound makers combined.

Proof.

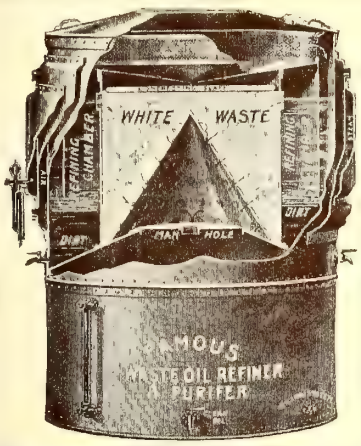
289 Street Railway Customers located as follows:

Alabama . . . 2	Indian Territory, 0	New Hampshire, 0	Virginia 4
Arizona 1	Iowa 4	New Jersey . . 14	Washington . 1
Arkansas . . 2	Kansas 1	New York . . 42	W. Virginia . . 2
California . . . 8	Kentucky . . . 3	N. Carolina . . 3	Wisconsin . . 6
Colorado . . 3	Louisiana . . . 1	N. Dakota . . 1	Wyoming . 0
Connecticut . 9	Maine 2	Ohio 39	Mexico 5
Delaware . . . 1	Massachusetts . 12	Pennsylvania . 38	Chili 1
Dis't Columbia, 2	Michigan . . . 10	Rhode Island . 1	Costa Rica . . 2
Florida 2	Minnesota . . 1	S. Carolina . . 2	Venezuela . . 1
Georgia . . . 3	Mississippi . . 2	S. Dakota . . 1	Brazil 1
Hawaii 0	Missouri . . . 2	Tennessee . . 3	Japan 4
Idaho 0	Montana . . . 1	Texas 4	Australia . . . 3
Illinois 26	Nebraska . . . 1	Utah 0	S. Africa . . . 2
Indiana 5	Nevada 0	Vermont . . . 0	Belgium . . . 1
			England . . . 3

Feed-water and boiler scale analyzed free of charge.

GEO. W. LORD

2238 to 2250 North Ninth Street, PHILADELPHIA, PA.



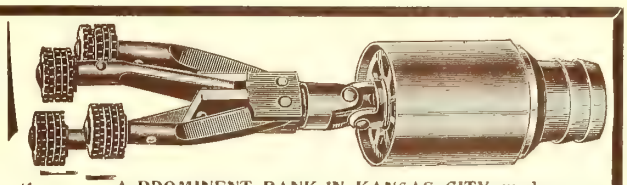
Is Your Filter a Fraud?

DETERMINE FOR YOURSELF

whether it has any real filtering capacity or other substantial merit, by examining the filtered oil with our Clean Oil Indicator. This microscopic device reveals the injurious grit and carbon found in most re used or filtered oils. Sent prepaid on receipt of 50 cents.

Our FAMOUS Filters are continually replacing those of every other make, because they are the only ones designed upon correct principles, which you will note from the interior arrangement shown in the cut and fully described in our catalogue. They will, moreover, deliver an absolutely pure quality of oil, which it is impossible for any other filter to do.

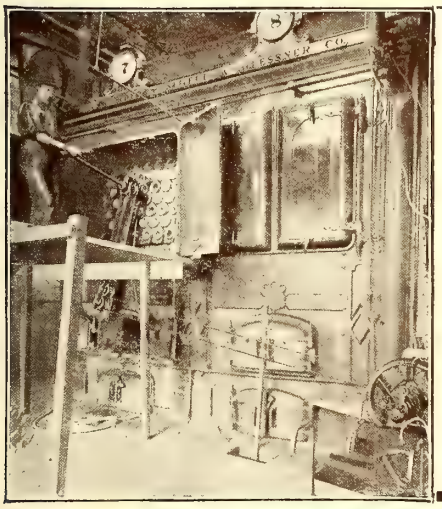
Sent on approval to any responsible firm. Write for new booklet on Modern Engineering Practice as applied to Oil Filtration and Lubrication. It contains facts which may interest and surprise you.



A PROMINENT BANK IN KANSAS CITY made over 1,000 per cent by investing in one of our Turbine Cleaners. It reduced its fuel bill from $450.00 to $200.00 per month.

New evidence of the superiority of this machine accumulates daily. We have just finished cleaning some water tube boilers where more than half of the tubes were totally filled with scale. This work required special drills which were inserted in place of the flexible head; but it easily did the work of a $1,500.00 power cleaner at only a fraction of the cost to buy, adjust, operate and maintain. It is not only the most rapid, economical and satisfactory apparatus for cleaning water tube boilers, but is practically the only one which will perform the work in most cases. Sent on approval. Boilers cleaned by contract.

CHICAGO BOILER CLEANER CO., 321 DEARBORN ST., CHICAGO, ILL.



HAVE YOU MONEY TO BURN?

You have if you allow scale to accumulate in your Boiler Tubes. . . . . .

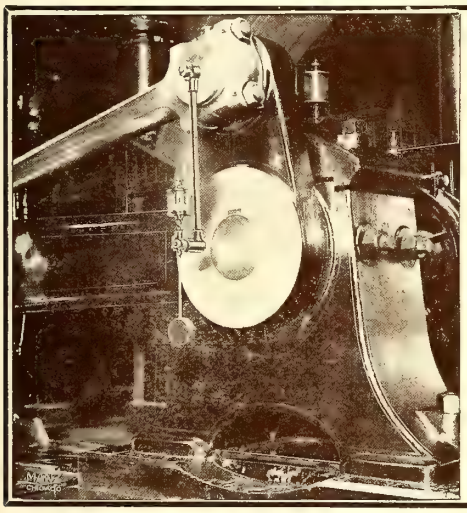
WEINLAND CLEANERS

will keep them clean.

The style illustrated will remove the heaviest scale—in the shortest time—at the smallest cost—with least trouble.

Machine sold outright or Boilers cleaned by contract.
Hand and Turbine Water Cleaners.
We are just what you need in this line.
Consult us before cleaning or buying.

THE LAGONDA MFG. CO., Springfield, O.



NUGENT'S PATENT PENDULUM CRANK PIN CENTER OILER

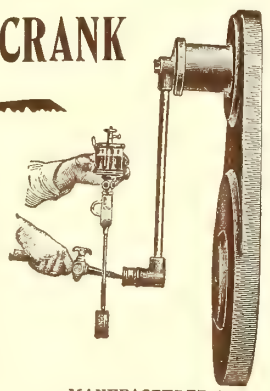
Note how EVERY DROP of oil MUST GO just to the RIGHT SPOT. It will save its cost in oil alone every three months, and it will enable you to run your engine 175,320 consecutive hours or 20 years, without having to stop to oil the crank pin, fill the oil cup or regulate the flow of oil, and it is ABSOLUTELY DUST PROOF.

The oil cup being ALWAYS STATIONARY may be removed while the engine is running at full speed, and a hot crank pin cooled off with cylinder oil or water. This is the correct way to cool off a hot Pin, for then the pin cools first and shrinks away from the brasses. The Oil Cup CANNOT come off of its own accord.

An uneven floor or a settling foundation or building CAN NEVER affect THIS STYLE OF CENTER OILER. The height of shaft above the floor cuts no figure either.

Note how easy it is to wipe up drip pans, sweep the floor and feel the pin. No stand in the way.

Be sure you have this Oiler put on your new engine when you buy.



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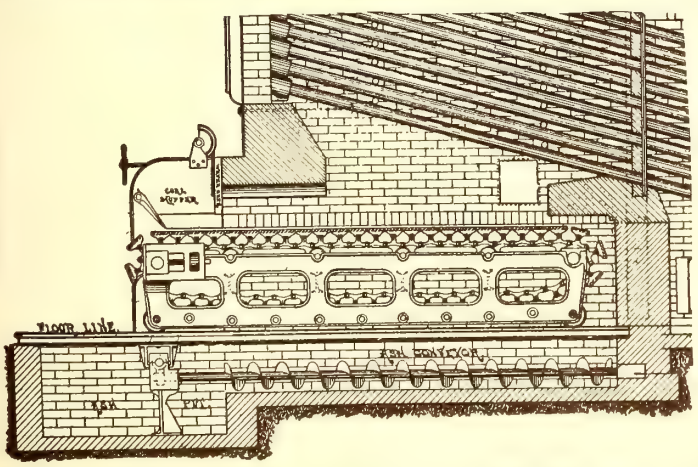

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ABSOLUTELY SMOKELESS.

Burns Bituminous Slack Economically Without Smoke.

Smoke Nuisance Problem Solved

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The Playford Stoker Co.,

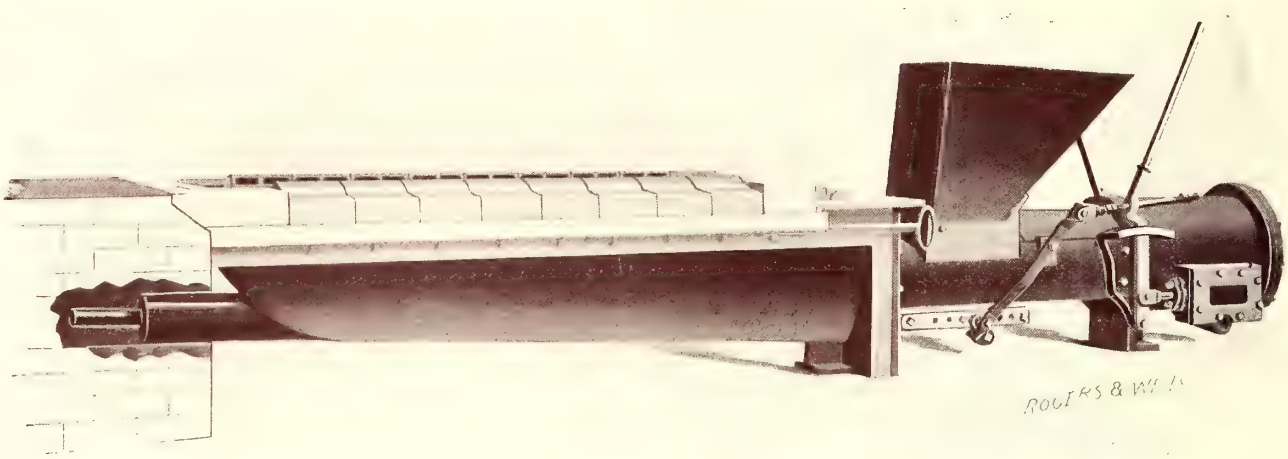
406 Telephone Building. CLEVELAND, OHIO.

THE UNDERFEED STOKER CO.

...OF AMERICA,...

Sole Manufacturers of the

JONES UNDERFEED MECHANICAL STOKER



The first and only successful Underfeed.

Especially Adapted for

Street Railway Power Plants

Uses Lump or Run of Mine (no crushing necessary),
as well as Slack and Screenings.
Durability Unquestioned. Repairs Nominal.
Sold under positive guarantees as to Saving in Fuel.
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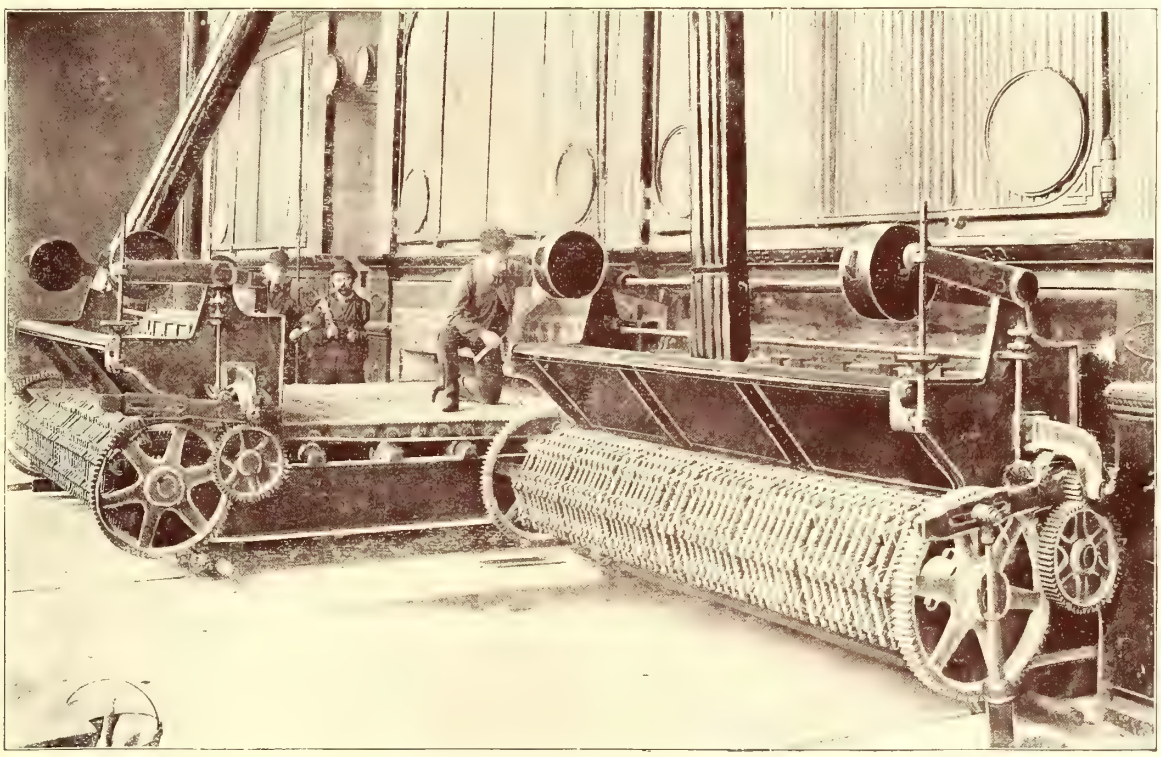
HIGHEST EFFICIENCY—SMOKELESS



ENTIRELY AUTOMATIC—LITTLE LABOR

Cut shows part of the installation made for the Milwaukee Electric Ry. & L. Co.

MANUFACTURERS OF THE

Green Traveling Link Grate

Applicable to all types of horizontal and vertical Water Tube Boilers, as well as tubular Boilers.

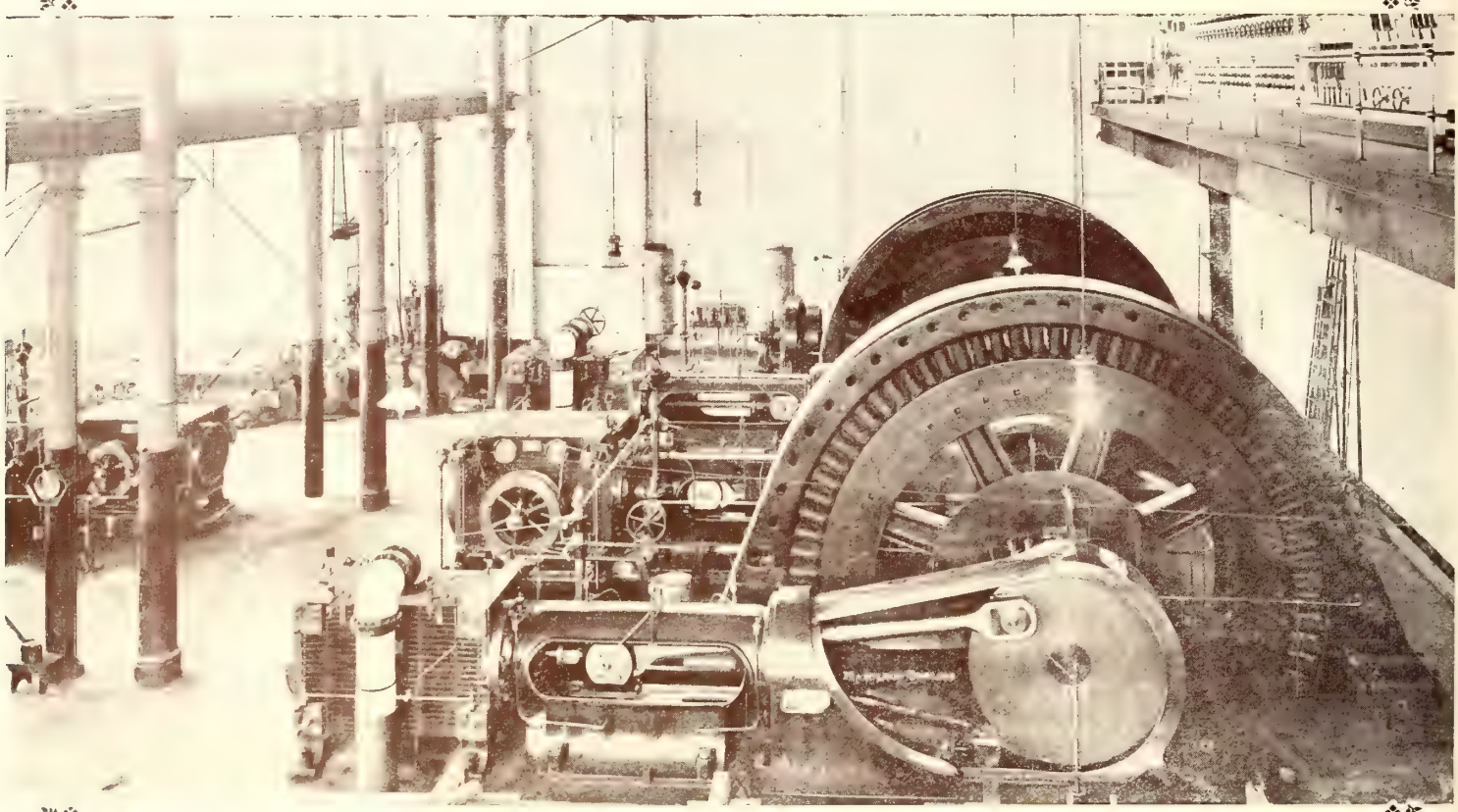
AMONG OUR INSTALLATIONS ARE:

Metropolitan Street Ry. Co., Kansas City,		1000	HP.
do.	do. 2nd order,	2000	"
Milwaukee Electric Ry. & Light Co.,		4000	"
do.	do. 2nd order,	6000	"
Chicago Union Traction Co.,		400	"
do.	do. 2nd order,	7600	"
St. Louis Transit Co.,		6400	"
do.	do. 2nd order,	6400	"
Armour Packing Co., Kansas City,		1000	HP.
do.	do. 2nd order,	500	"
Cincinnati Edison Electric Light Co.,		3000	"
do.	do. 2nd order,	1500	"
do.	do. 3rd order,	700	"
Sharon Steel Co.,		3000	"
do.	do. 2nd order,	5000	"
United States Glue Co.,	2 orders,	1600	"

All widths and sizes for boilers ranging from 100-1000 H.P. Write us for further information.

SIEGRIST AUTOMATIC OILING SYSTEM

(PATENTED)



ABOVE showing part of Station "B" of the Missouri Edison Electric Co., St. Louis, Mo., and two Hamilton Corliss Cross Compound Direct Connected Engines, 6,000 H. P. Plant, perfectly and automatically lubricated, 200 gallons of oil forced over bearings daily, which means no Hot Bearings or Journals, and large saving on wear and tear on machinery. Plant operated by one Engineer and one Wiper on each watch (two watches). Note Automatic Oiling Table and Tanks at far end, oil handled once, barrel to tank, saving one company $450.00 a month, others in proportion.

YOU WILL ADOPT APPARATUS, IF YOU WILL WRITE TO ABOVE AND THE FOLLOWING PLANTS AND GET THEIR OPINIONS.....

Imperial Electric Light, Heat and Power Co., St. Louis, Mo.
Metropolitan West Side Elevated Railway Co., Chicago, Ill.
Armour & Co., South Omaha, Neb.
United Railways Co., St. Louis, Mo.,
McCormick Harvesting Machine Co., Chicago, Ill.
St. Joseph Railway, Light, Heat and Power Co., St. Joseph, Mo.
Cudahy Packing Co., Kansas City, Mo.
Union Gas and Electric Co., 40 Wall St., New York.
B. F. Goodrich Co., Akron, Ohio.
Grand Crossing Tack Co., Grand Crossing, Ill.
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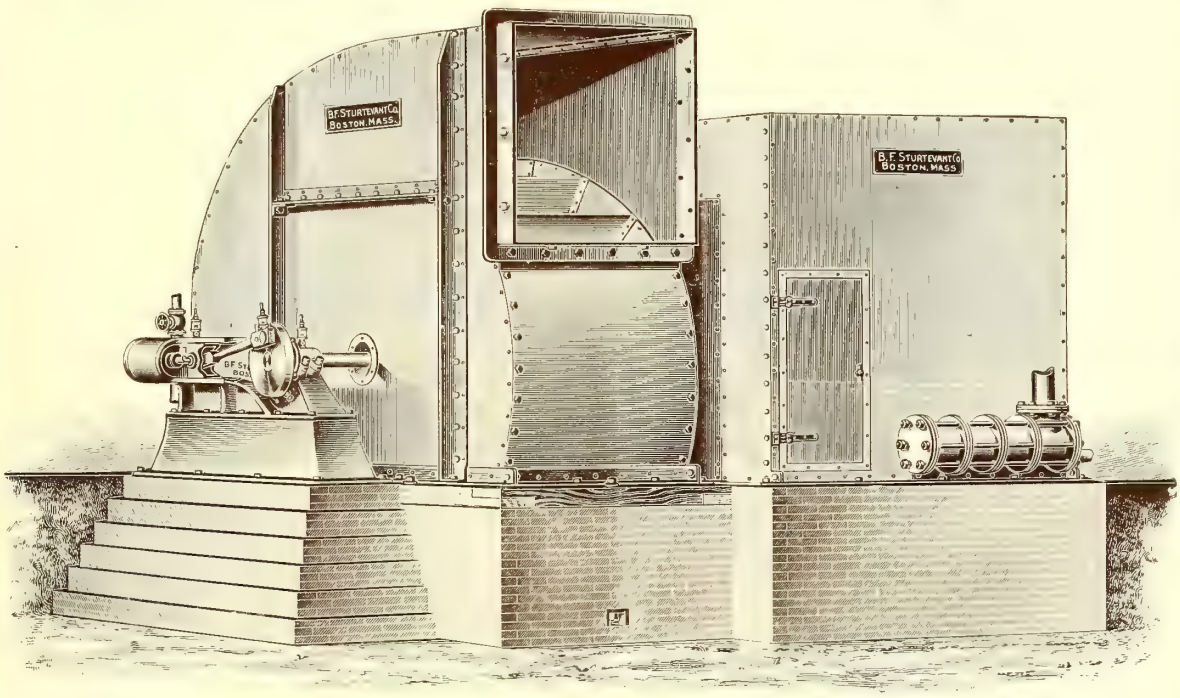
We will not consider it any trouble to make you a proposition as to cost, if you will let us know your wants.

WRITE FOR CATALOGUE.

SIEGRIST LUBRICATOR CO. (Makers), ST. LOUIS, MO.

The Sturtevant System OF HEATING AND VENTILATION

by a Forced Circulation of Warm Air is applicable to all classes of buildings



The Sturtevant System is Superior to Direct Heating

Because

- The apparatus is centralized and under one man's control
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- Consequently no danger of freezing or of damage from leaky joints, valves, or aircocks
- The heater is specially adapted to the use of exhaust steam
- Heating can be accomplished with great rapidity
- Building can be cooled and ventilated in summer
- Humidity can be regulated

Because

- Ample and positive ventilation is provided
- Quantity and quality of air are under absolute control
- Constant temperature can be maintained and air volume varied when "hot and cold system" is used
- The heating surface is enclosed in a fire-proof casing
- The air ducts are fire-proof
- There is no tendency to noise
- Operation is independent of wind and weather

Send for Catalogue No. 112 describing *the* system in detail

B. F. Sturtevant Company Boston Mass.

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131 Liberty St.	135 N. Third St.	16 S. Canal St.	75 Queen Victoria St.

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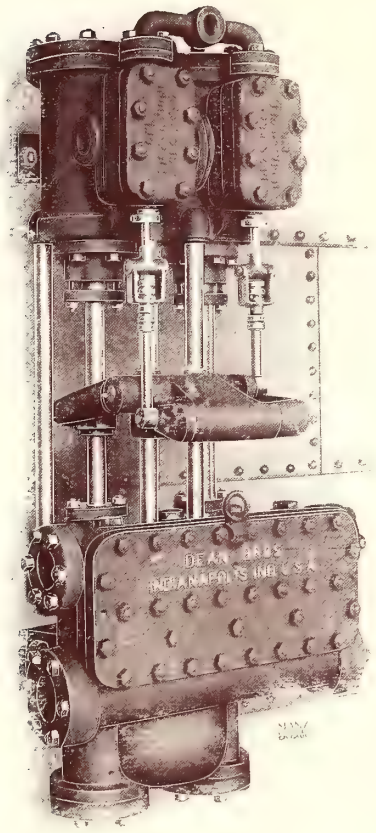
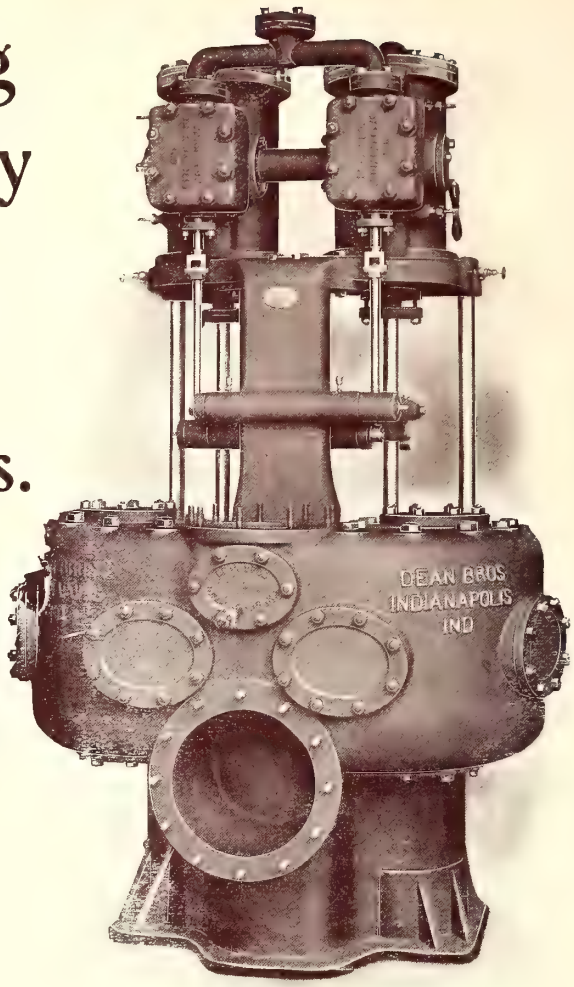
Pumping Machinery for all Purposes.



DEAN BROS. VERTICAL DUPLEX BOILER FEEDER
MARINE OR ADMIRALTY STYLE.
Made for Heavy Pressure and Hard Service.



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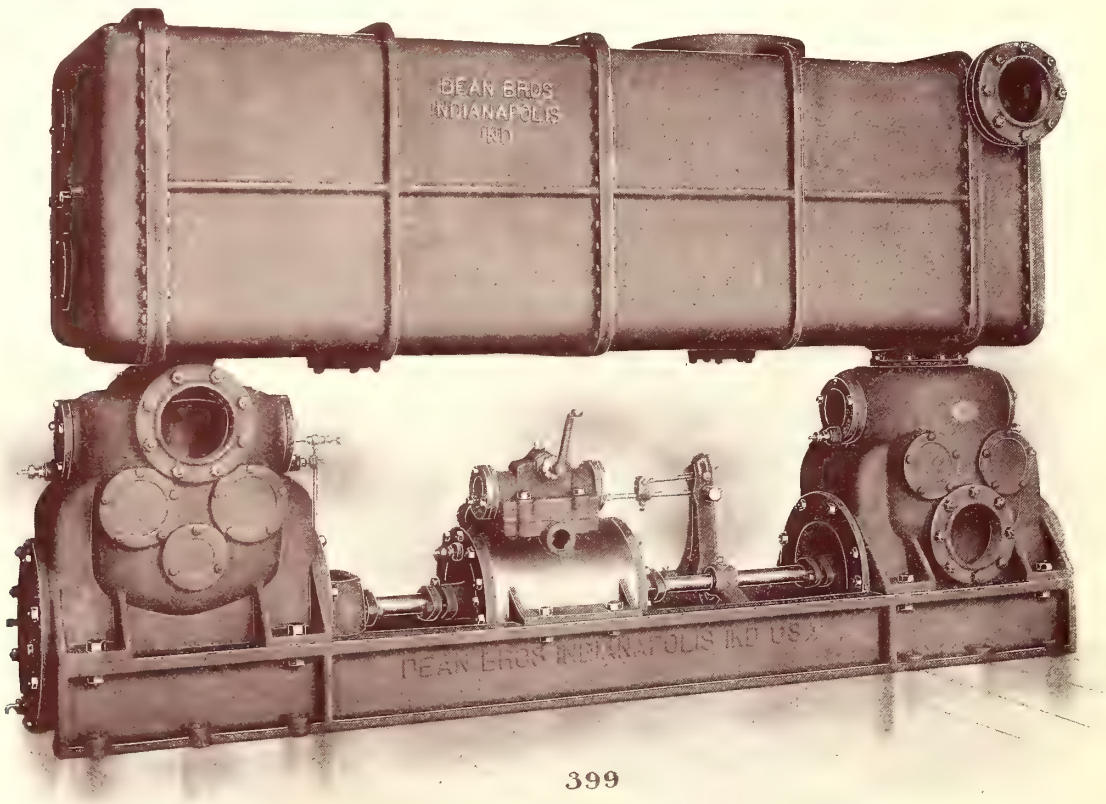
DUPLEX WATER SUPPLY PUMP.
VERTICAL TYPE.



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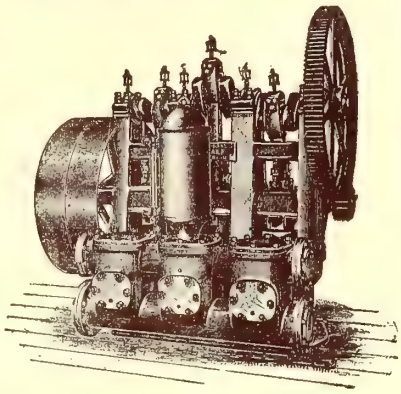
SURFACE CONDENSER WITH COMBINED AIR AND CIRCULATING PUMPS.

DEAN BROS. STEAM PUMP WORKS,

INDIANAPOLIS, INDIANA.

Power Pumping Machinery

TRIPLEX
and...
DUPLEX



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Gas or Gasoline
Pumping Plants
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Railway Service, General Water Supply, etc.

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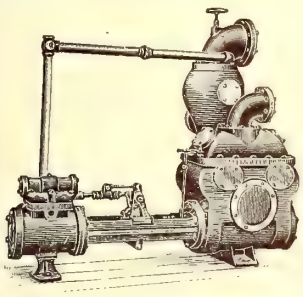
use exhaust steam, and supply boilers with PURE HOT WATER, and prevent the solid matter from going into the boilers, saving from 10 to 25 per cent. of your fuel bills. Our latest design is made entirely of cast iron, designed for use where water contains acids, salt or other impurities, which pit or corrode wrought iron or steel.



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AIR PUMPS
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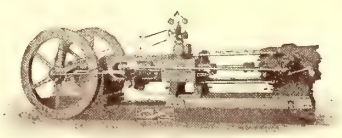
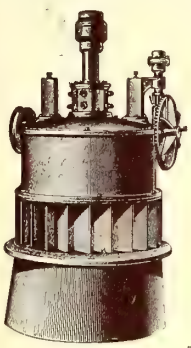
AIR Compressors

for pumping water, operating rock drills, coal cutters, pneumatic tools, general service in railway shops, blast furnaces, refineries, machine shops, etc., etc.



The Victor Turbine



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GREAT CAPACITY
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PERFECT CYLINDER GATE
STEADY MOTION

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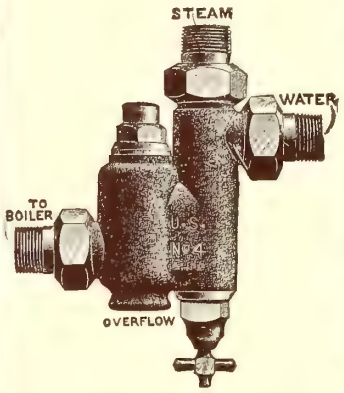

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in small space, but our little "ENGINEERS RED BOOK" goes into details. It also solves 500 or more engineering problems that every engineer will be interested in.

Write for one.

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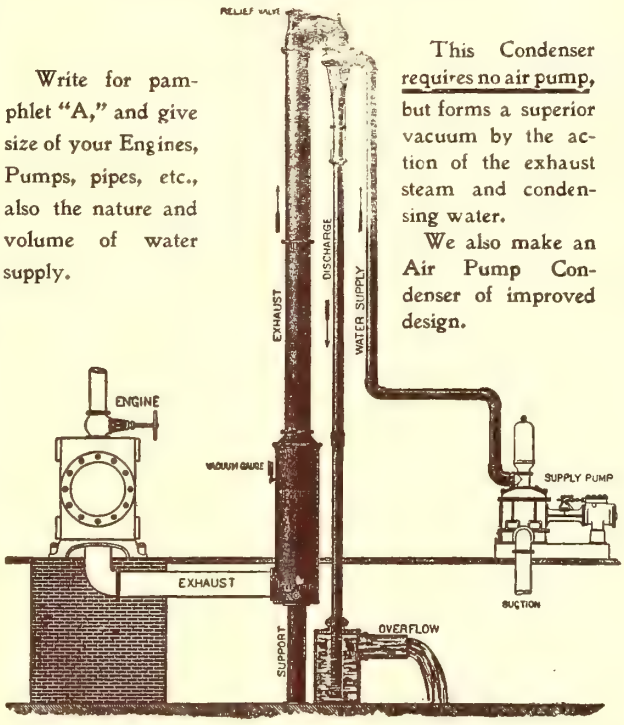
Write for pamphlet "A," and give size of your Engines, Pumps, pipes, etc., also the nature and volume of water supply.



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We also make an Air Pump Condenser of improved design.

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New York Office,
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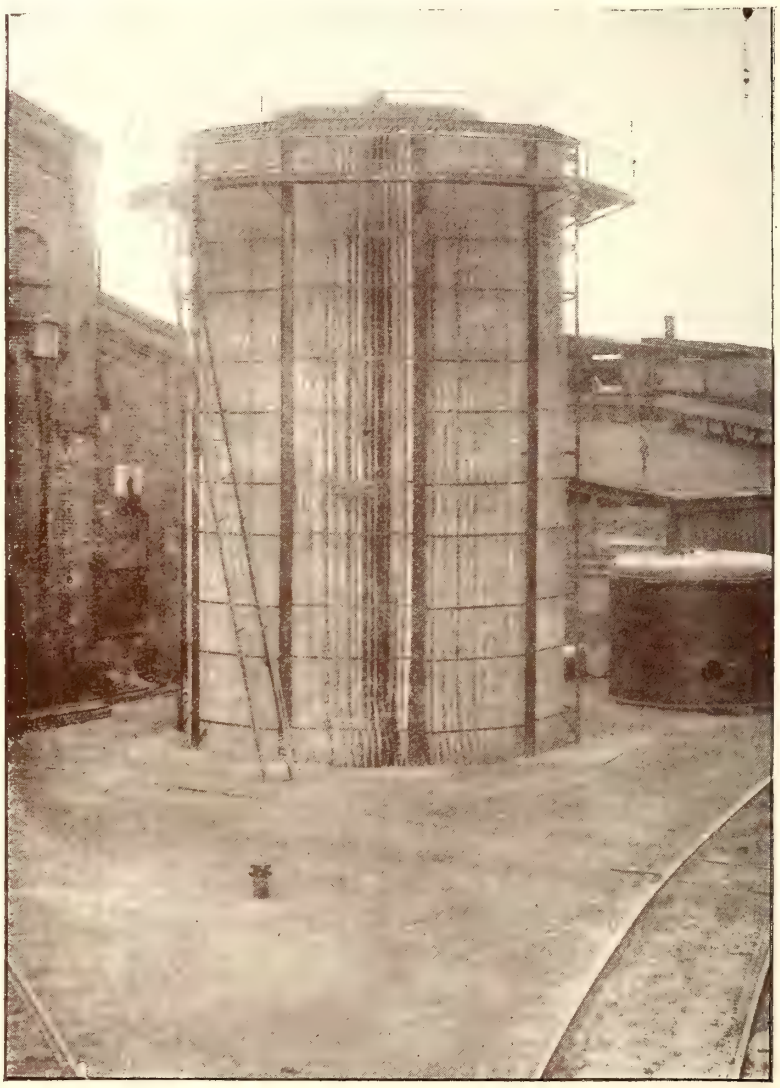
WHEELER SURFACE CONDENSERS,

FEED WATER HEATERS,

WATER COOLING TOWERS,

STEAM AND ELECTRIC PUMPS.

If you are contemplating the Installation or Alteration of a Steam Plant we shall be pleased to give advice and prepare Plans and Specifications.



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Barnard Fanless Self-Cooling Water Tower.

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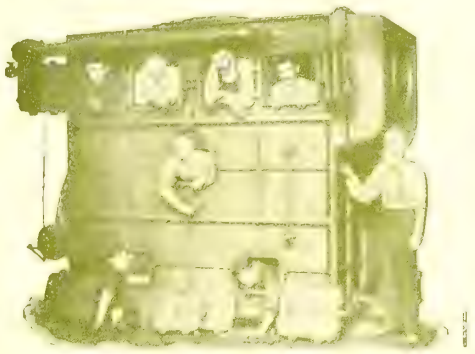
COCHRANE HEATERS



TIME and surface are given in the COCHRANE HEATERS, for the settlement and deposit of the insoluble matter. For the detention of the precipitation and deposit which occur while the water is being heated removable trays are placed in the steam space in the upper part of these heaters.

Further depositing service is gained by carrying a filter bed of any suitable material, such as coke, hay, gravel, etc., and of considerable extent and depth, in the water storage space, which is made amply large to allow the water to travel slowly through the heater. Every provision is made for quick and easy cleaning. The trays may be removed or cleaned in place. The openings for introducing fresh filtering material, and for removing the old charge, with its collection of scale forming matter, are well placed and of convenient size.

A MAN CAN ENTER ANY OF THESE HEATERS THAT IS LARGE ENOUGH TO HOLD HIM. : : :

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Manufacturers also of
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Removed, May 1, to 85 Liberty St., New York.

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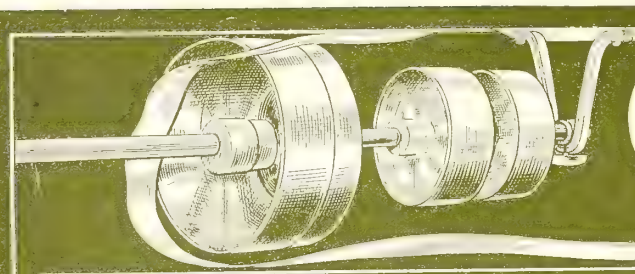

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A belt never runs off the pulley until it starts to slip.
Cling-Surface will prevent any belt from slipping—we guarantee it.
Cling-Surface also preserves the belt and increases its power at least 15 per cent.

Write for a trial can. It costs nothing if it doesn't do as we say. Cling-Surface will earn the cost of a sample can in a fair-sized plant in one month.

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DOING RIGHT BEATS DOING TWICE

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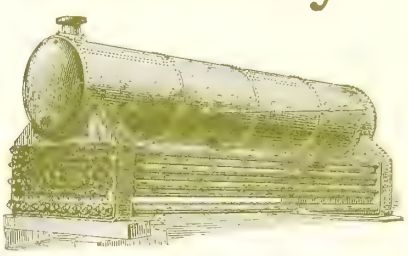

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Water Tube Boilers
Shops at Phoenixville, Pa.; Troy, N. Y.; St. Louis, Mo. and Chicago, Ill.

Any Shrinkage

in running expenses means a distension in net profits, and, of course, the greater the shrinkage the greater that welcome — distension. THE WEBSTER FEED WATER HEATER and PURIFIER saves fuel and water to an extent that renders it a recognized earning power wherever it is installed. Shall we tell you all about it?

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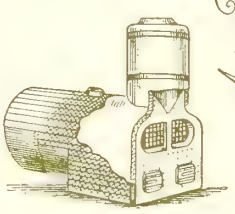

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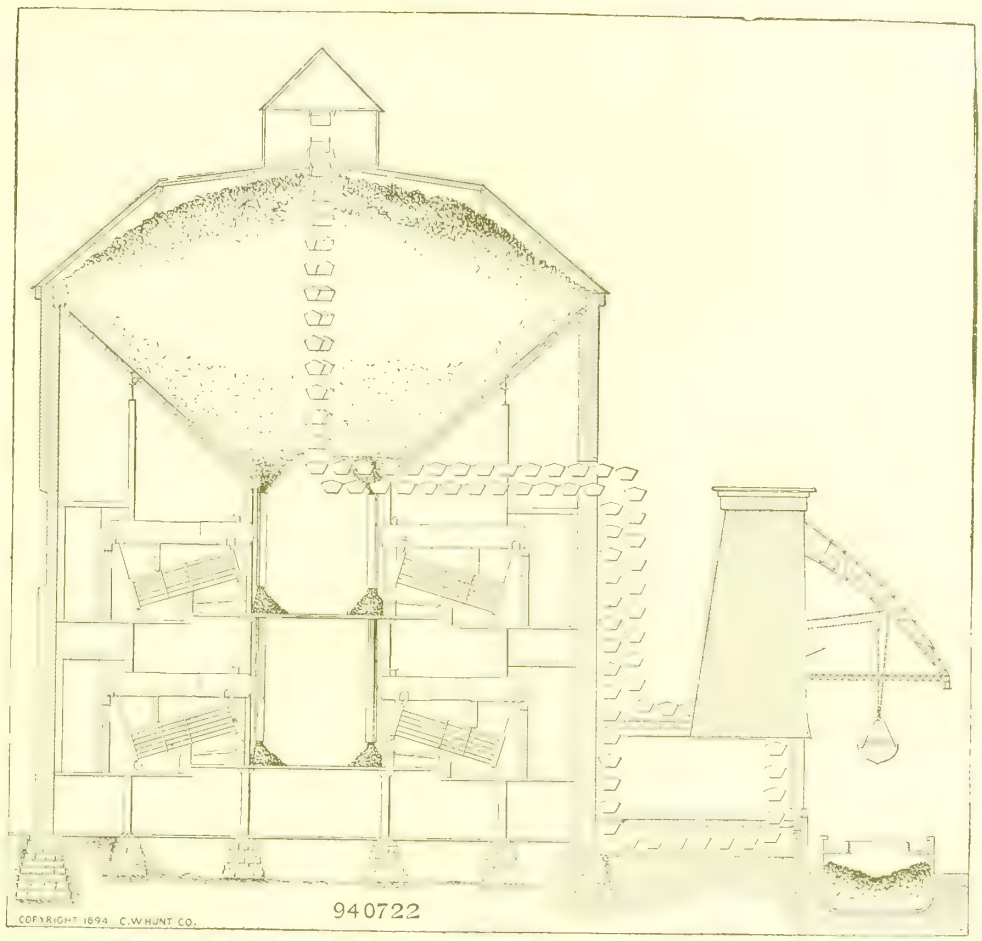

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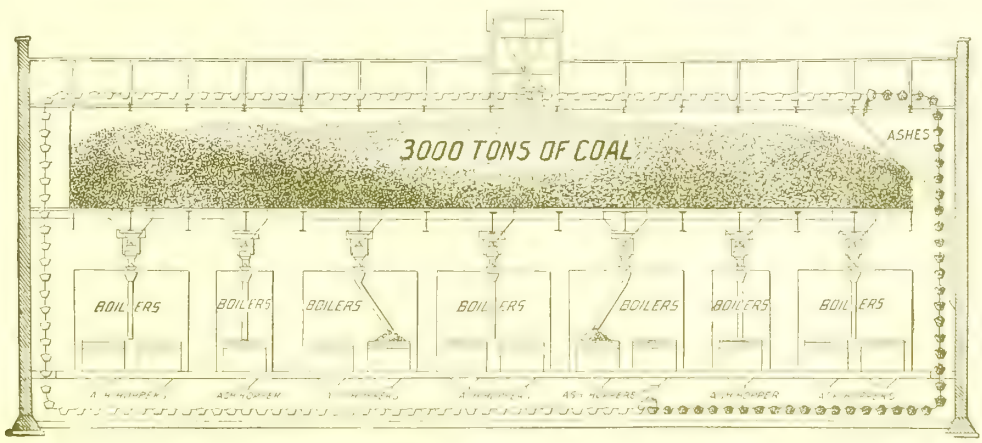

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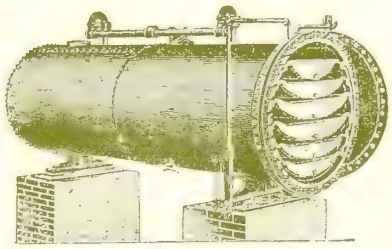

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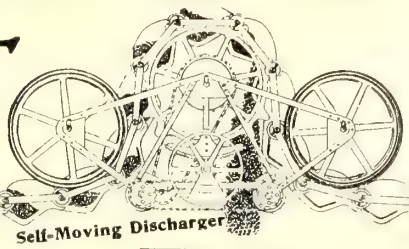

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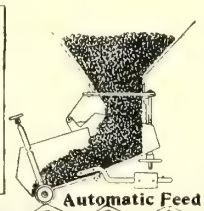

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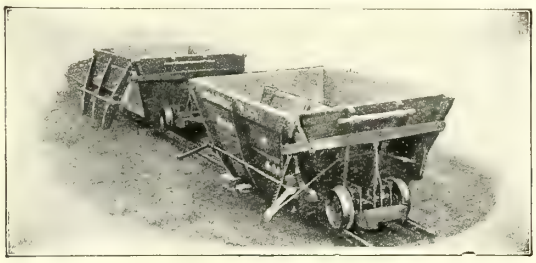

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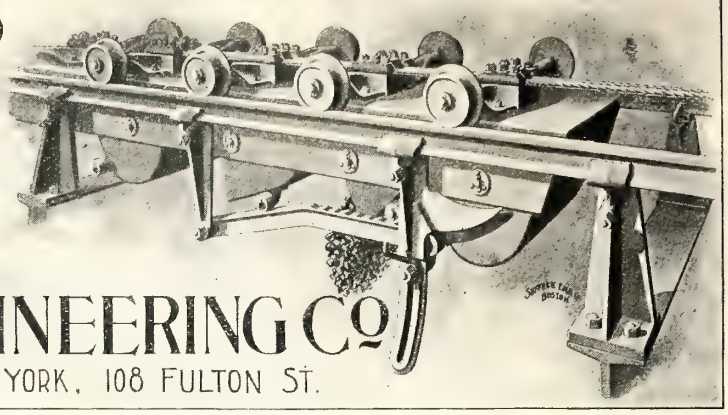

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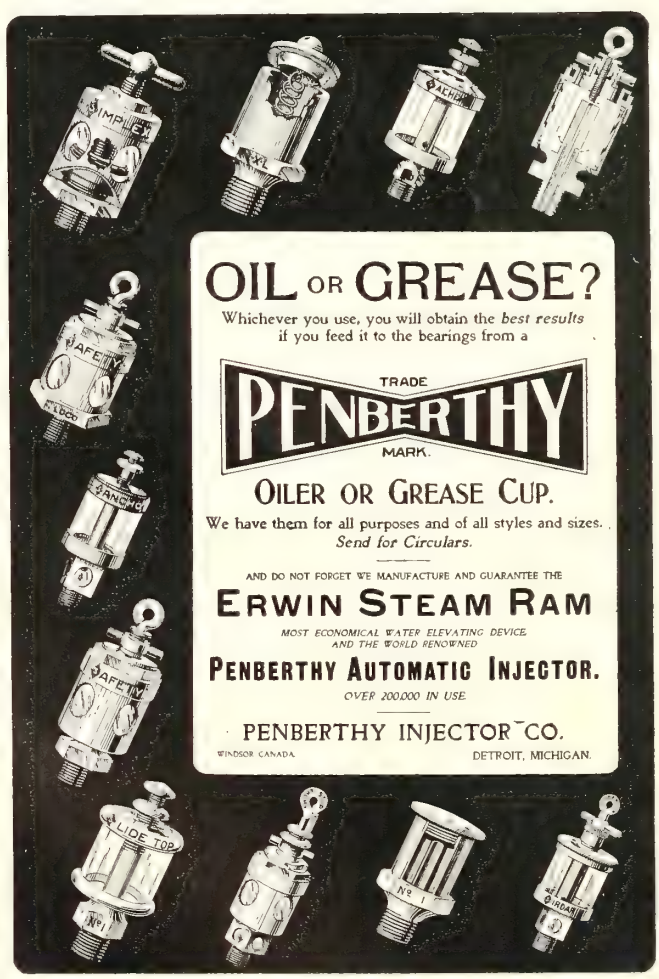

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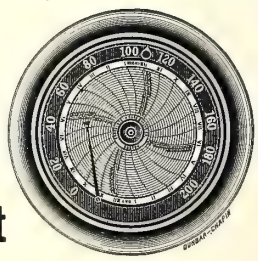

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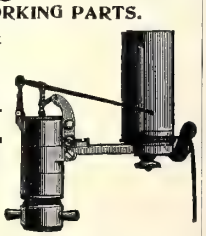

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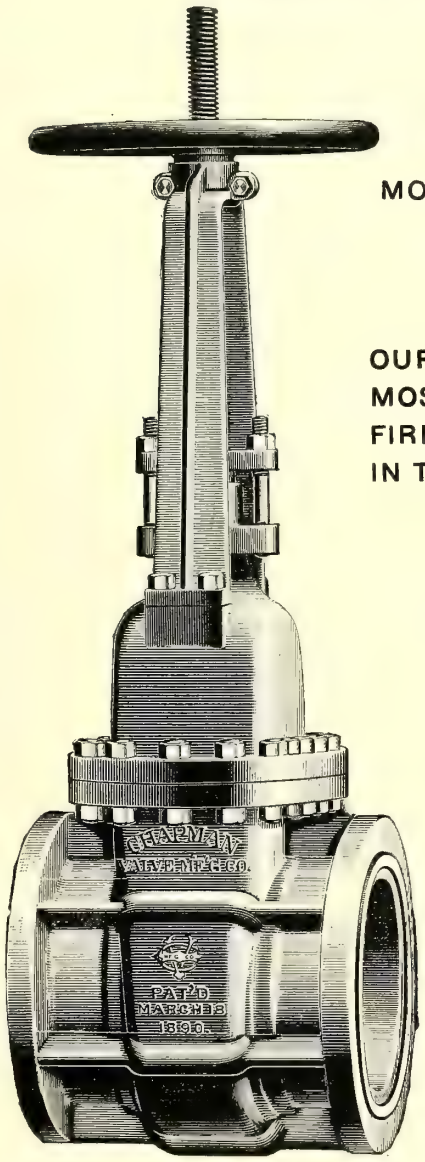

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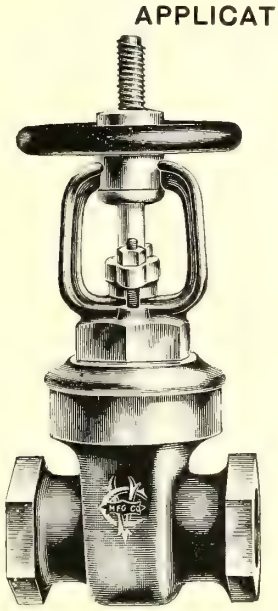

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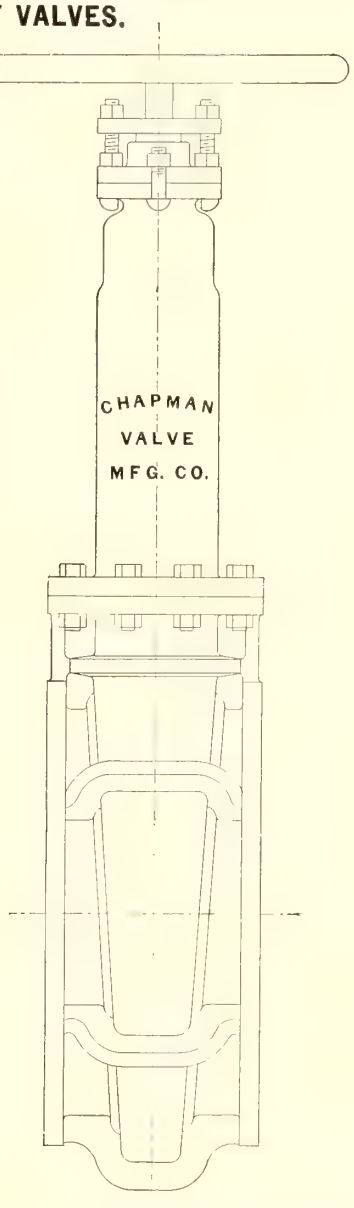

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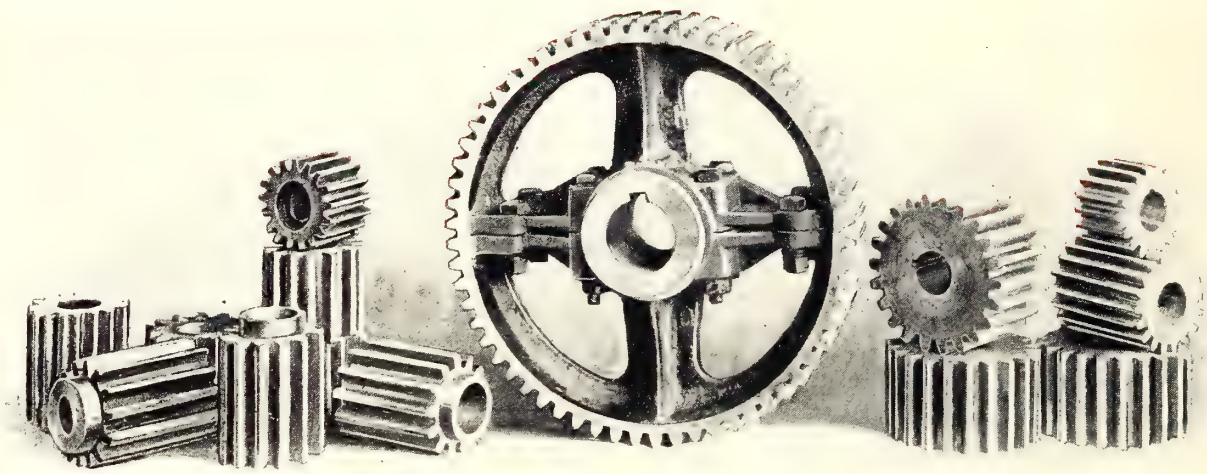

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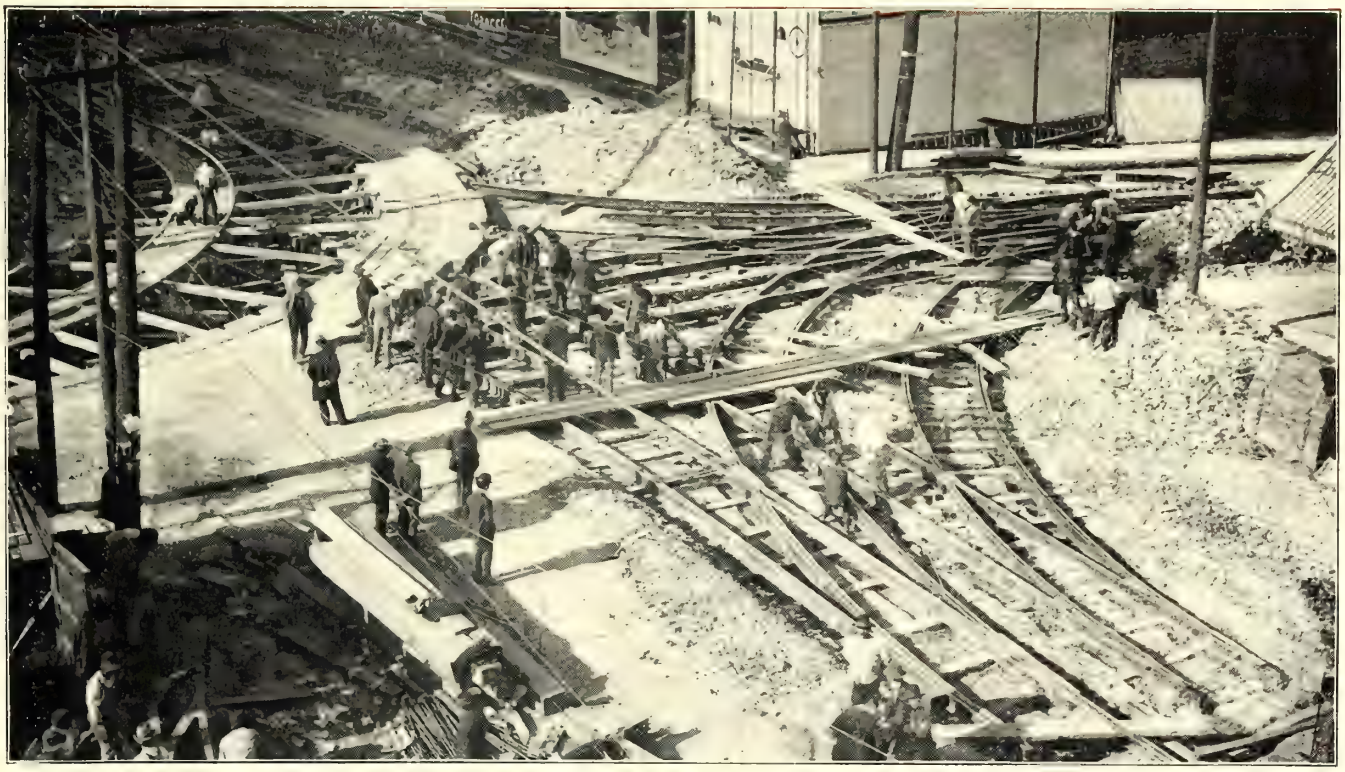

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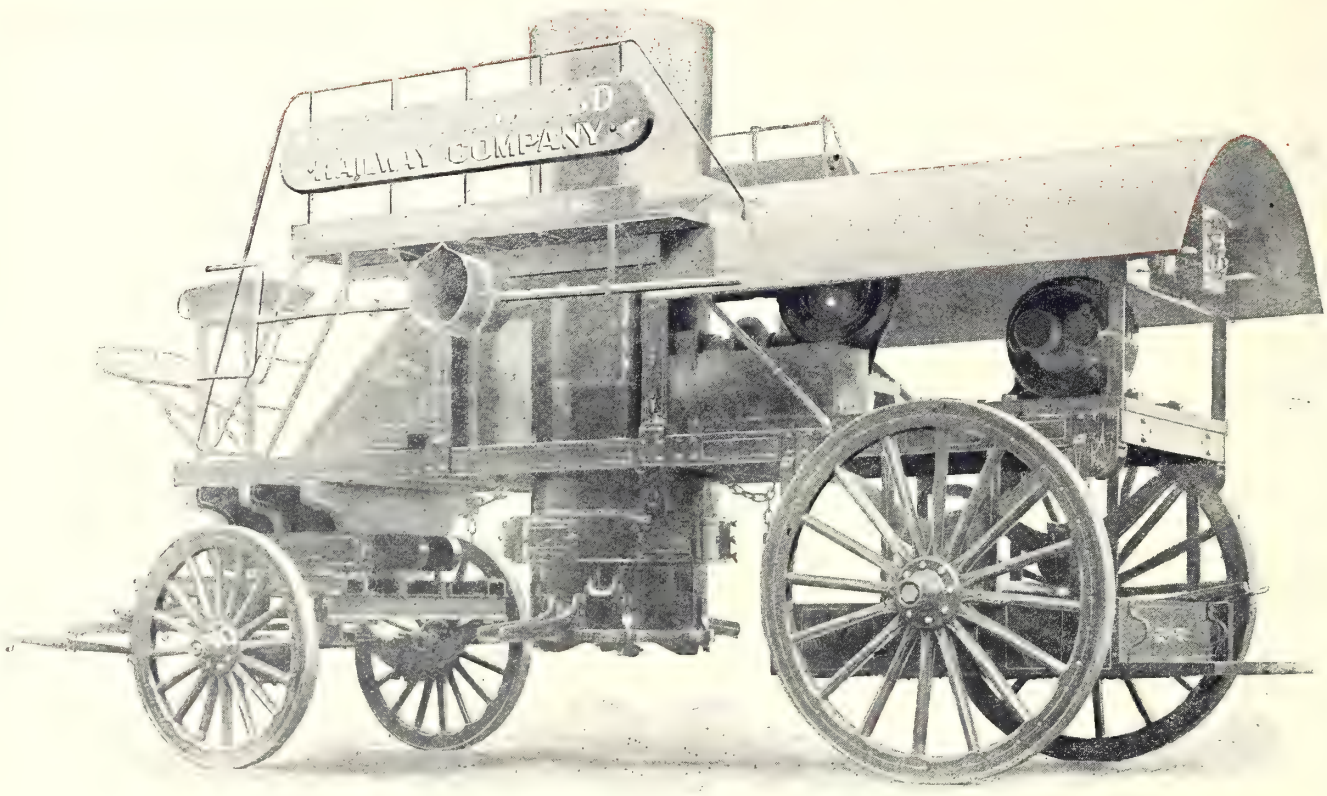

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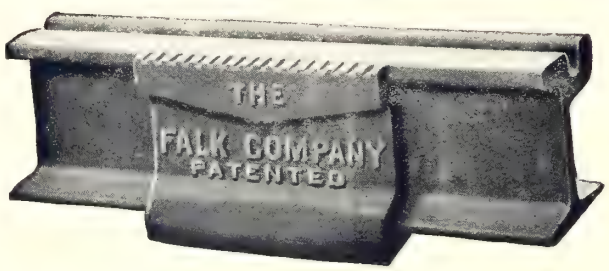

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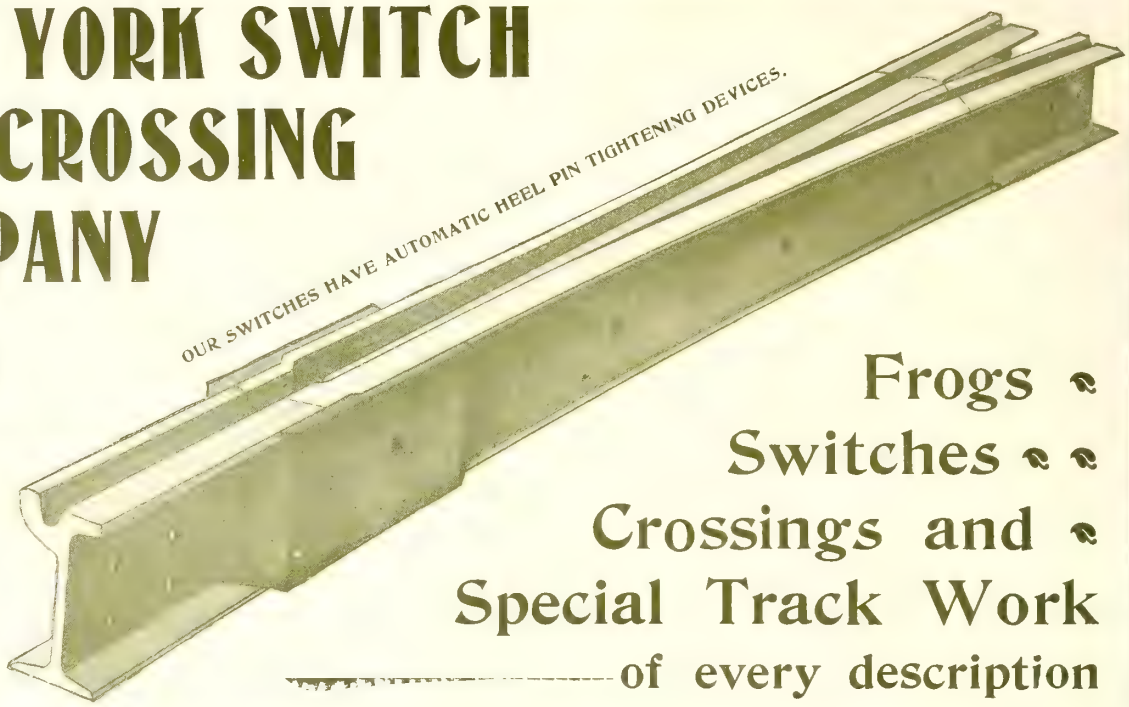

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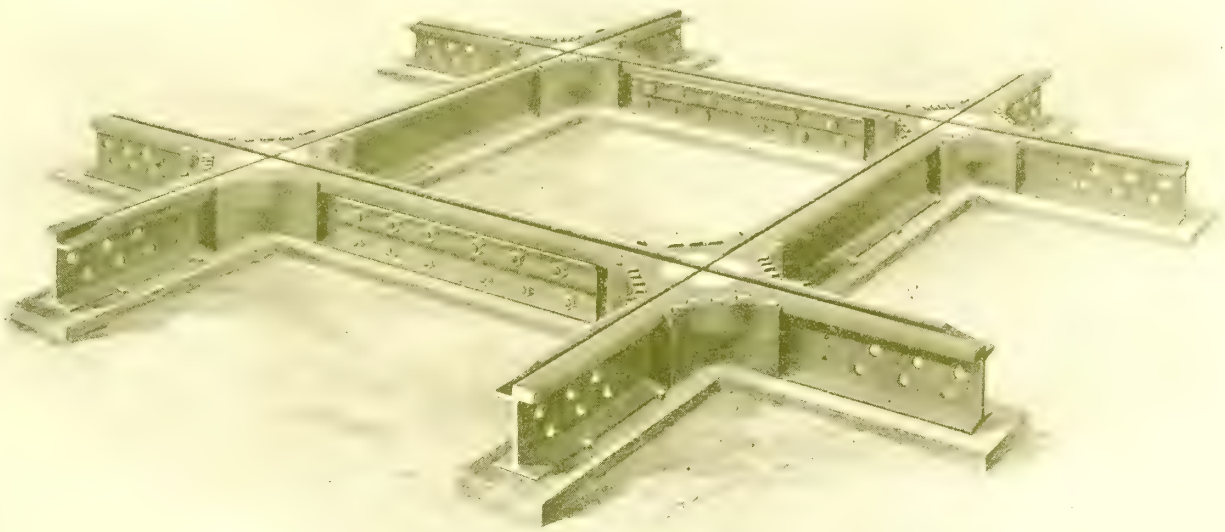

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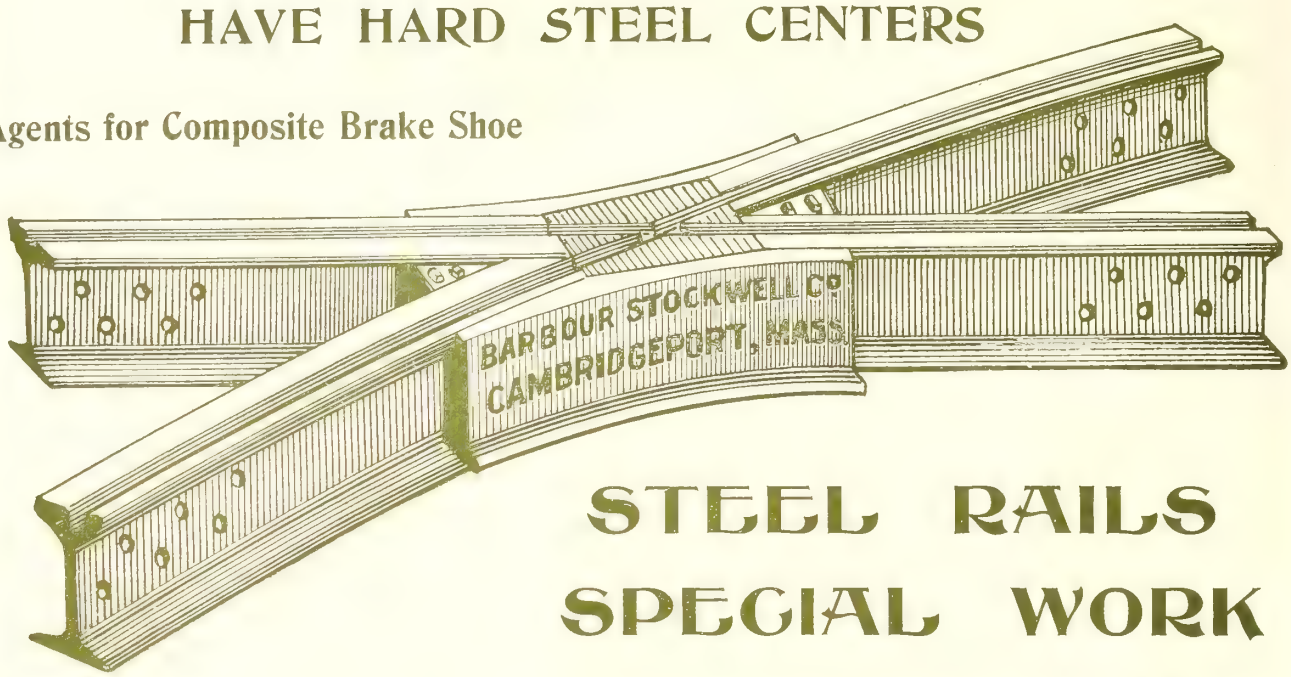

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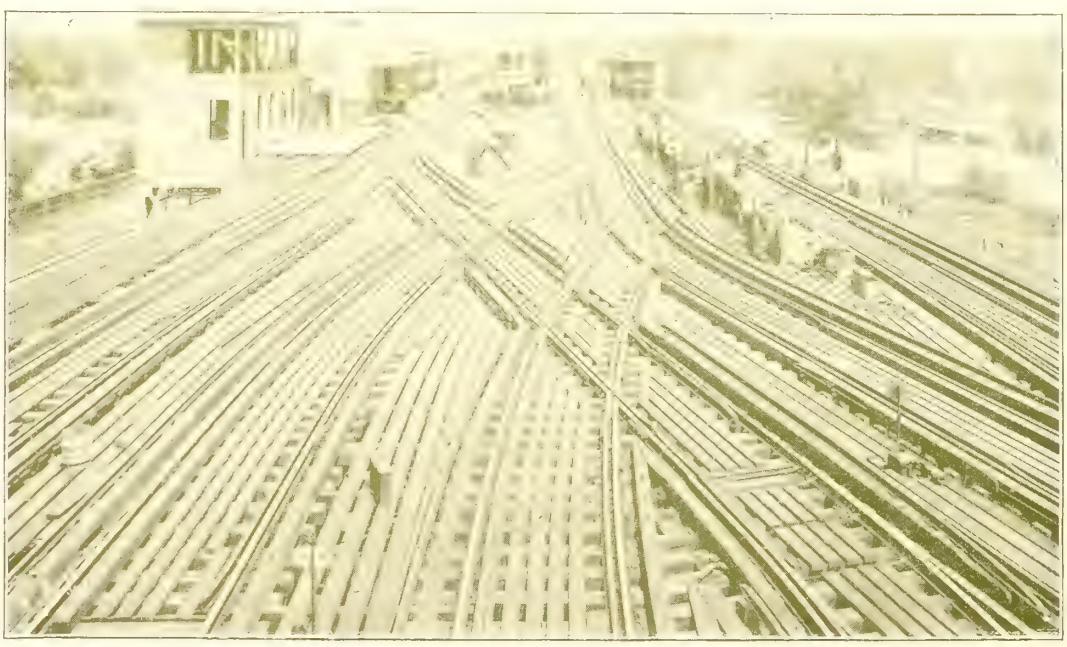

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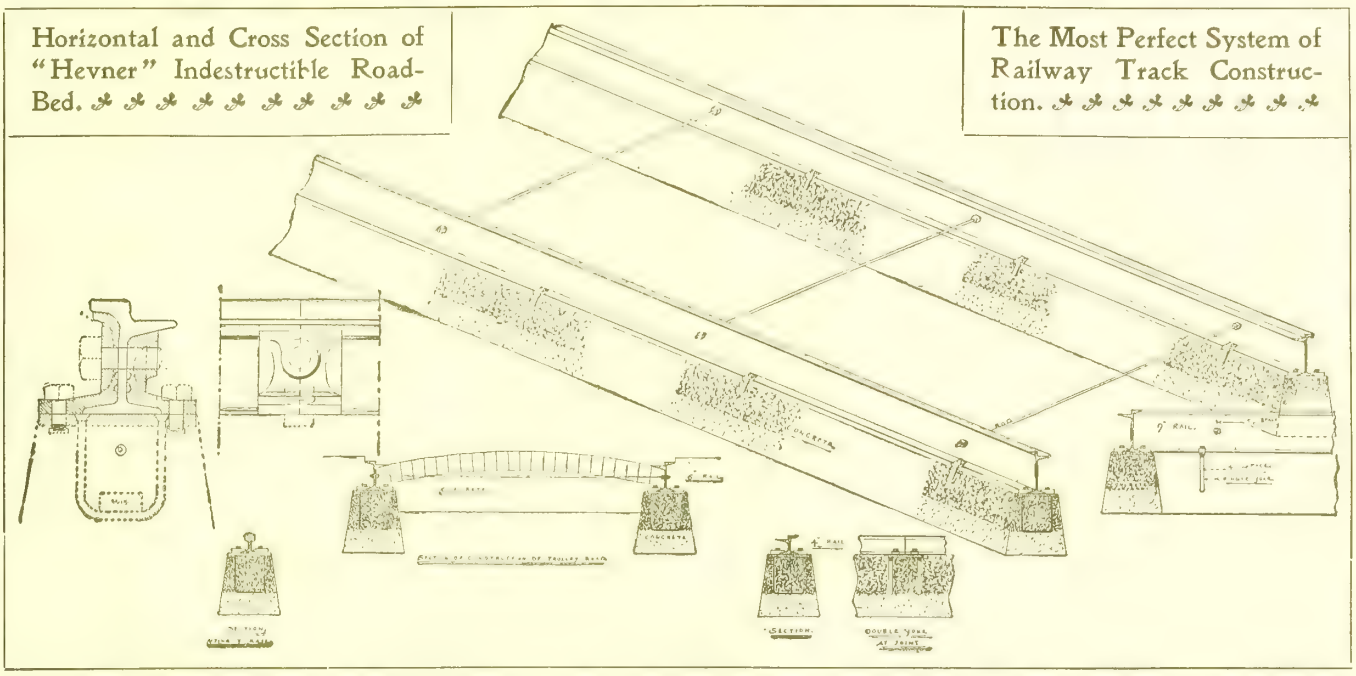

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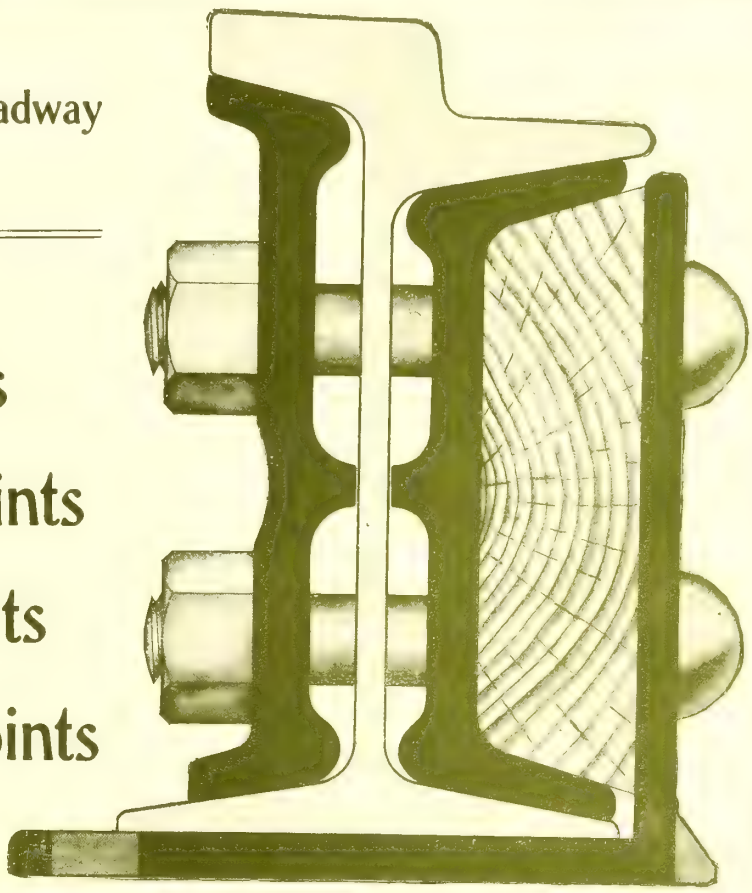

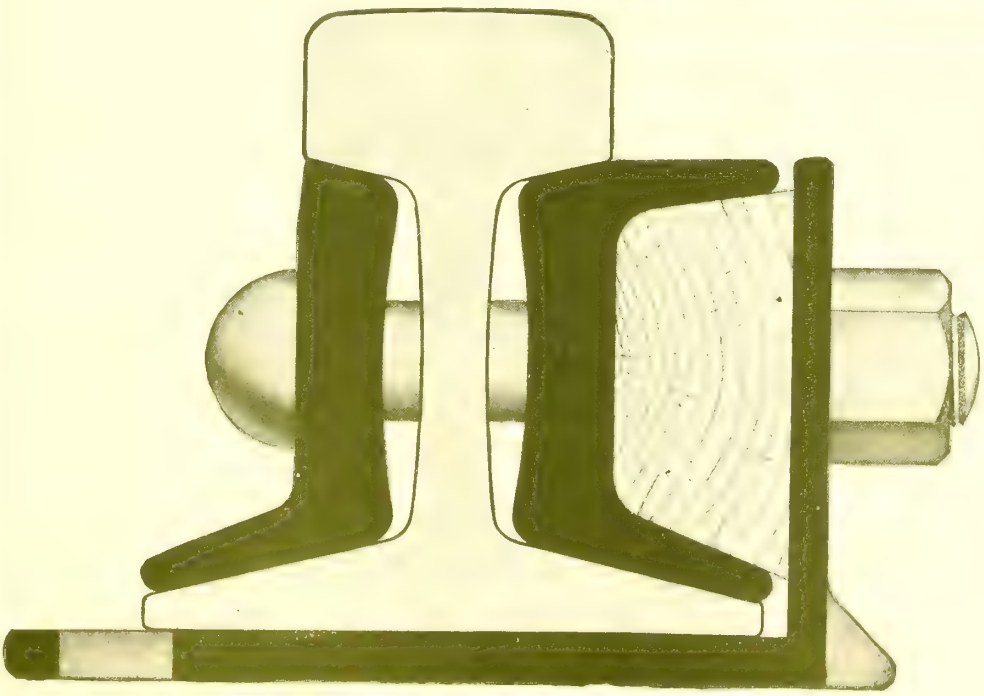

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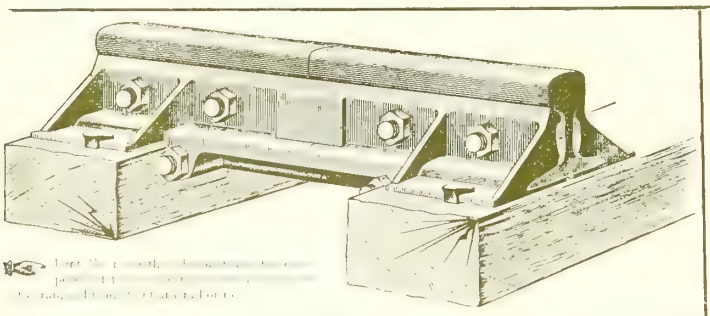

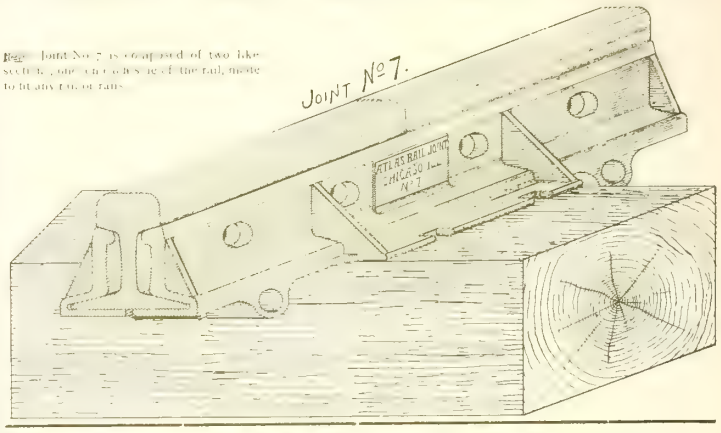

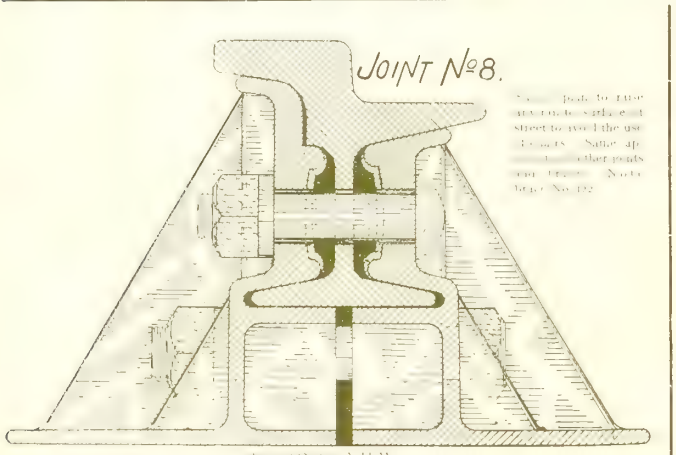

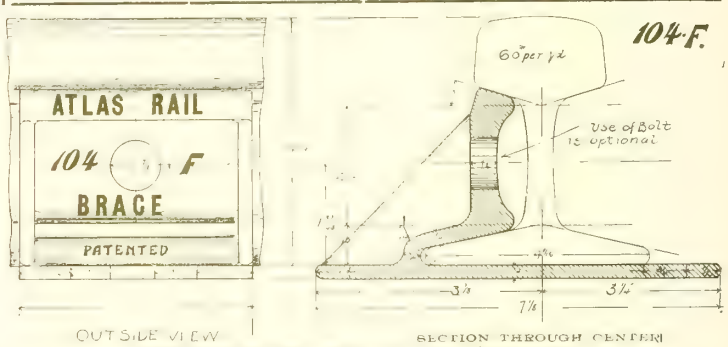

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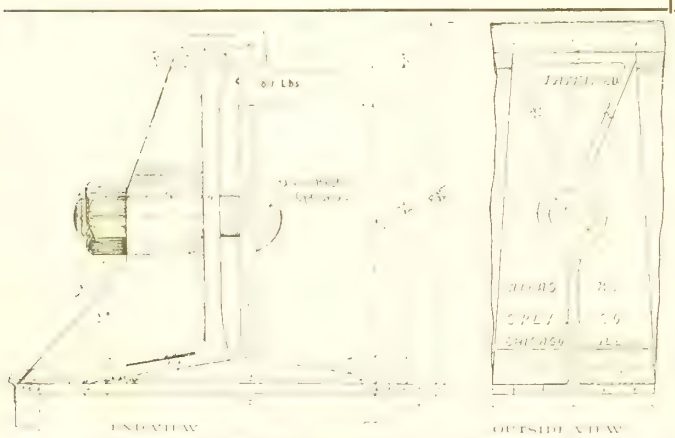

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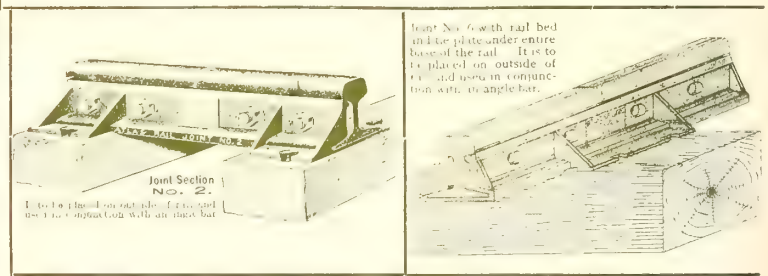

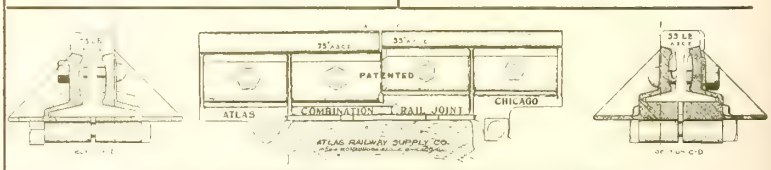

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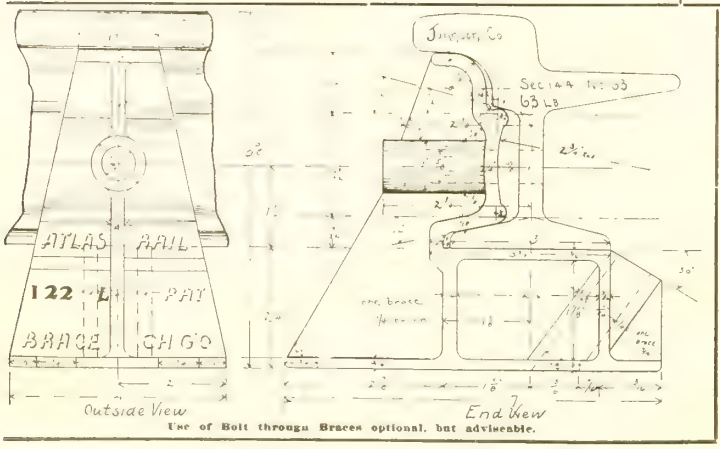

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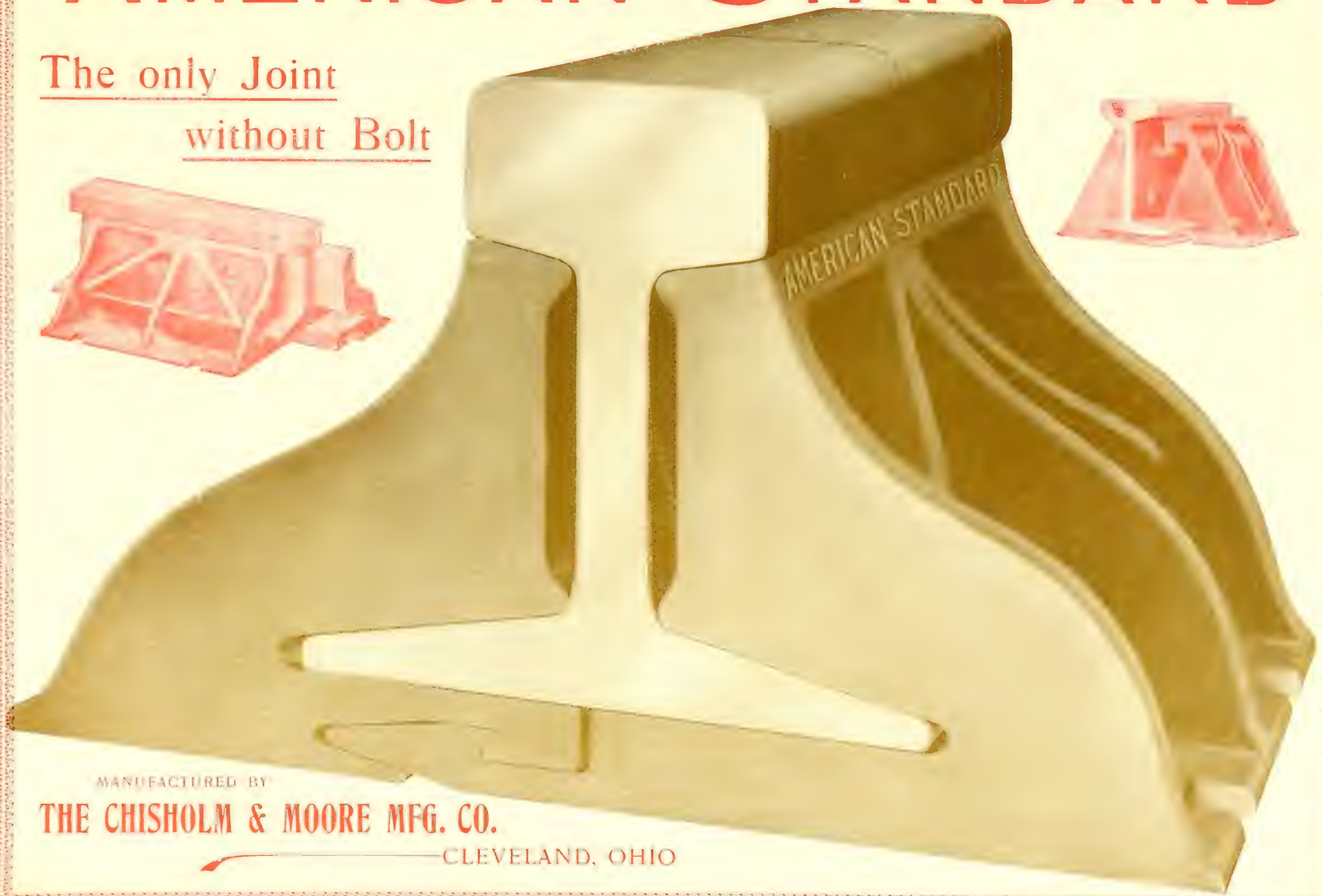

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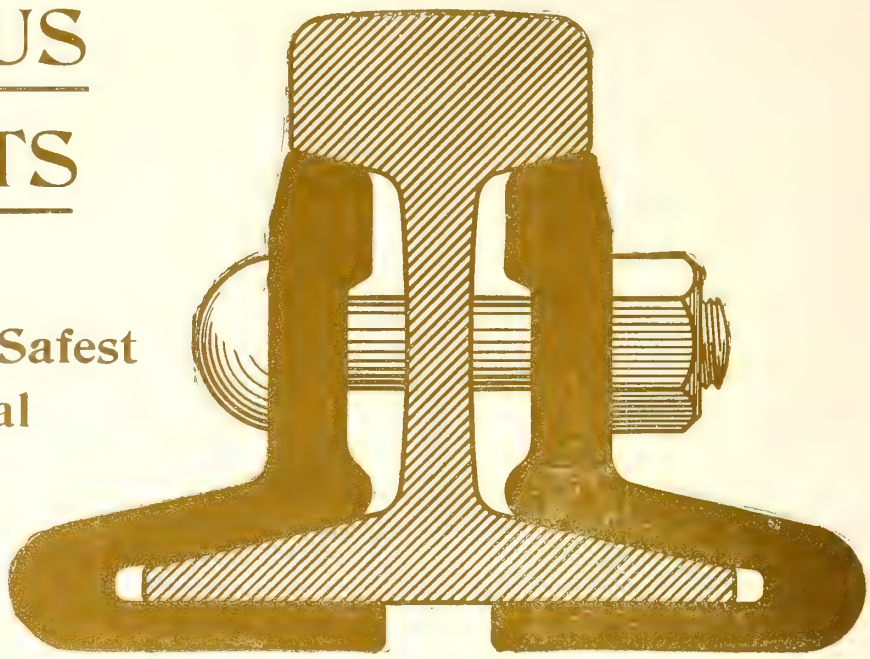

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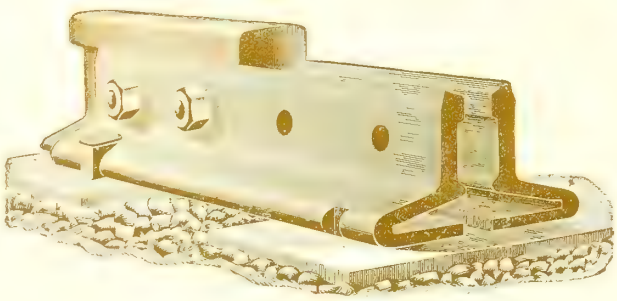

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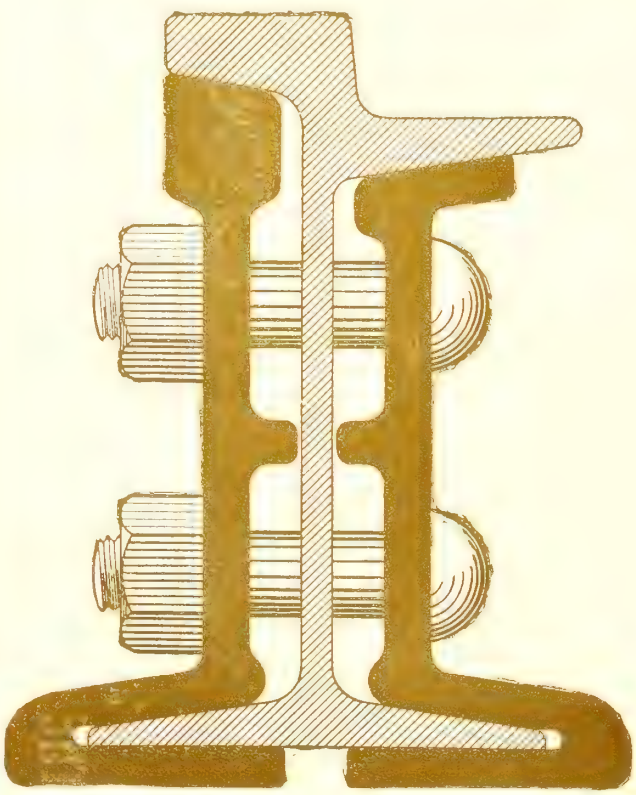

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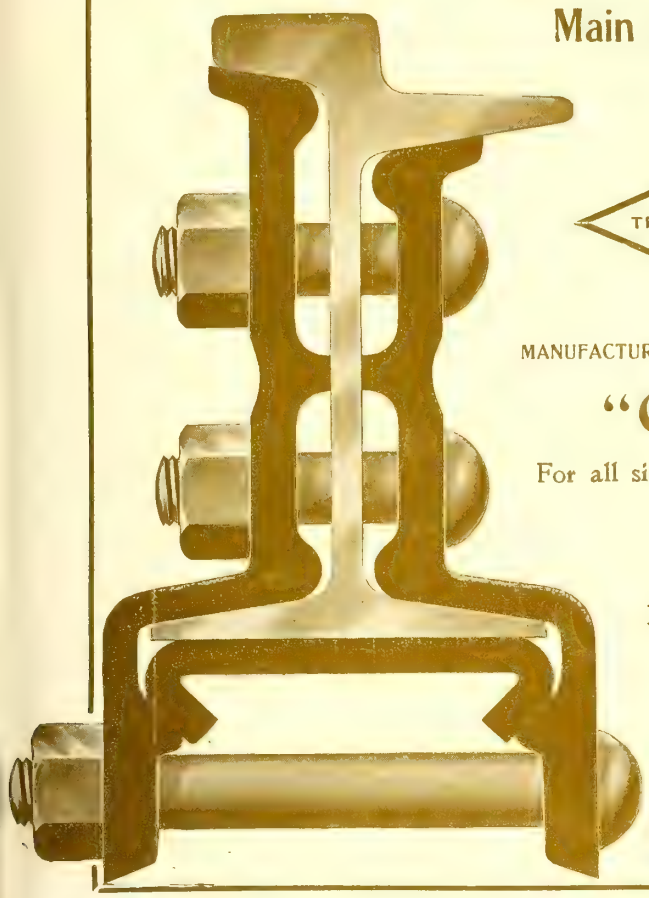

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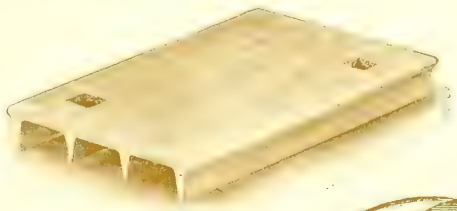

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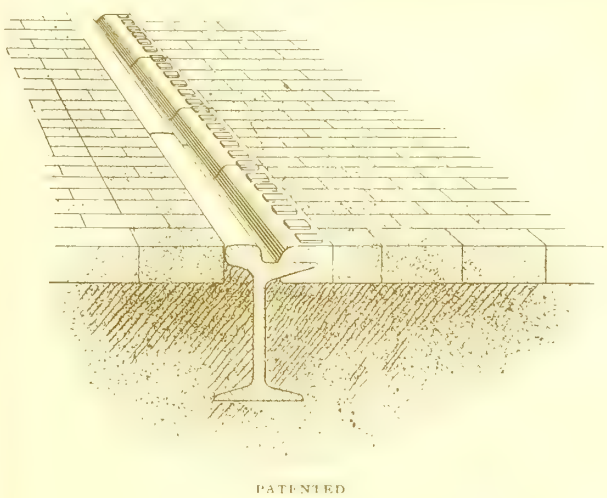

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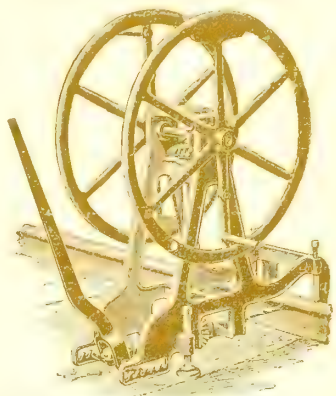

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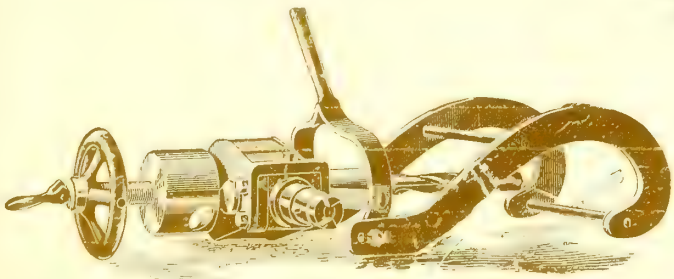

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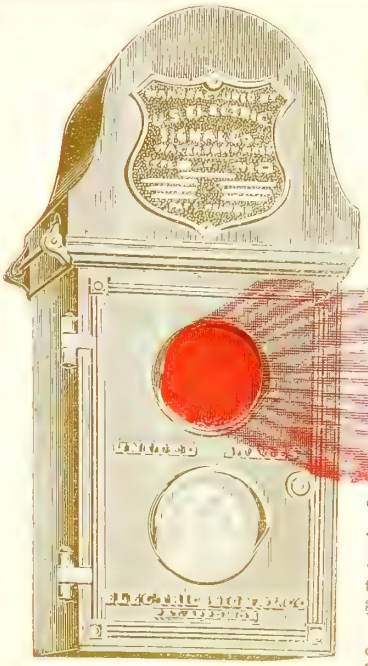

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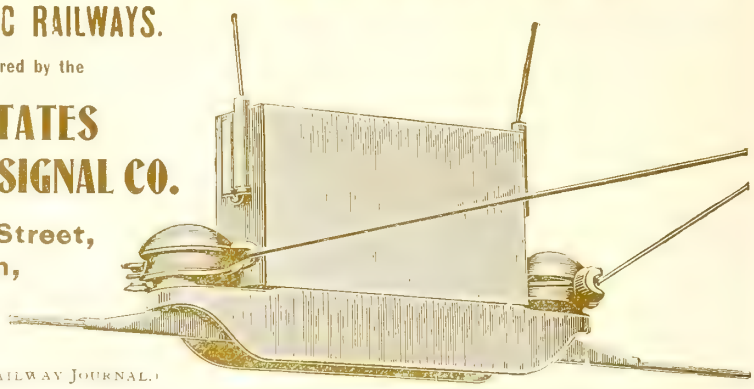

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The signal boxes are usually placed a short distance beyond a turn-out and consist of substantial cast-iron cases. The doors of these cases are provided with two windows, one covered by a red glass and the other by a green or white glass; there are two incandescent lamps in each box, one just back of each window. The boxes are always used in pairs and are connected by two wires, and number twelve galvanized iron covered with a weather-proof braid is well adapted to this purpose. Our signals are in use on the following roads: Lynn & Boston, Plymouth & Kingston, Schenectady Railway Company, Quincy & Boston, Newton & Boston, Lexington & Boston and others. Patents for our devices are owned by the company, some are granted and some are pending. Steps have been taken to secure foreign patents. **We append a few testimonials from some of the roads:**

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United States Electric Signal Co., Watertown, Mass.

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LEXINGTON & BOSTON STREET R. R. Co.
H. B. Parker, Gen. Manager.

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L. H. McLain, Supt. NEWTON & BOSTON STREET RY. Co.

BOSTON, Sept. 8, 1900.

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GENTLEMEN:—Your signal which we have in use on the Plymouth and Kingston Street Railway is working perfectly. We find it a great convenience as well as a safeguard in running our cars and are now putting in the others you have sent us.

Yours very truly,

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First Practical Work on Railway Motors

CONTENTS

CHAPTER I.—Forms of Field Magnets. II.—Armature Winding Diagrams. III.—Field Coil Construction and Arrangement. IV.—Armature Construction. V.—Commutator and Brush Holder Construction. VI.—Motor Casings. VII.—Motor Suspensions. VIII—Bearings and Gears. IX.—Lubrication. X:—General Dimensions and Data. XI.—Management and Repair. XII.—Railway Motor Design.

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THIS IS A BOOK unique in its treatment of electric railway equipment. The first ten chapters are devoted to minute description of the details of electric railway motors that are in use to-day. Each organ of an electric railway motor is taken up in turn, described and illustrated by examples of present and past practice, and its operation explained in the light of practical experience. In short, the review of current practice is of such a nature as to bring out the reason why the electric railway motor is built as it is to-day. For example, field magnets of different types of motors are illustrated and compared, and their features of merit and faults pointed out. Armatures, armature windings, brush holders, suspensions and other details are similarly treated, each detail, however minute, being exhaustively considered. The last two chapters are devoted, one to the management and repair of electric railway motors, and the other to railway motor design, a complete design being worked out as an example. A table gives authoritative data of all types of railway motors in common use, both in America and Europe.

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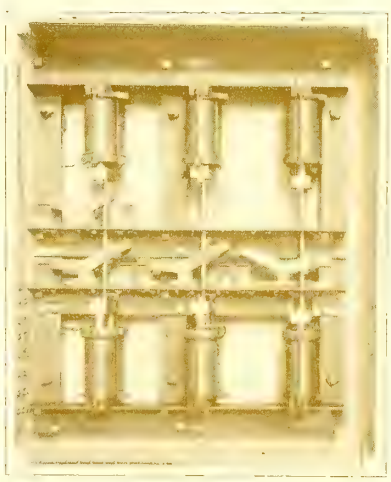

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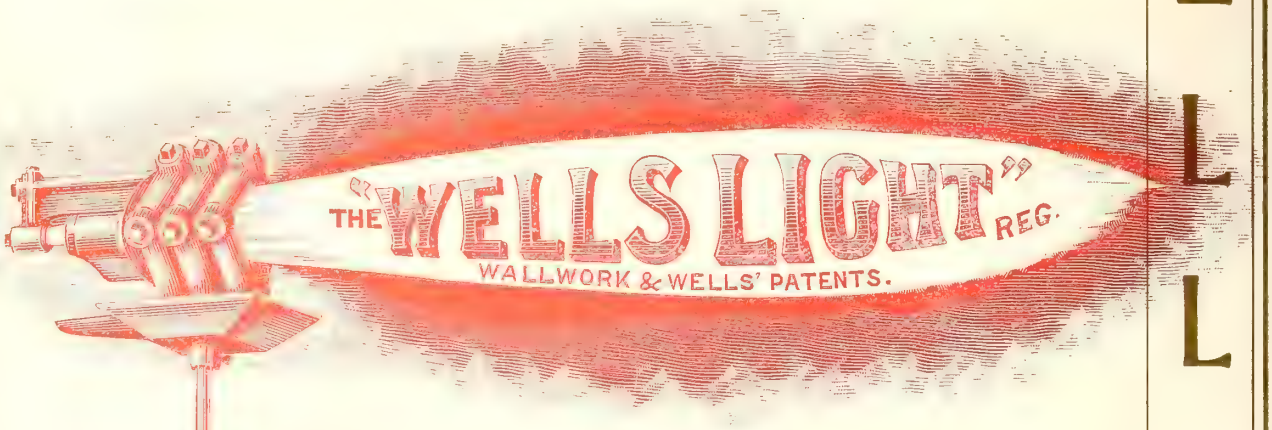

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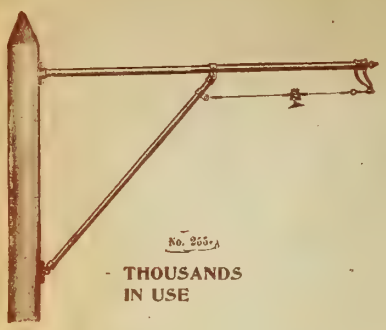

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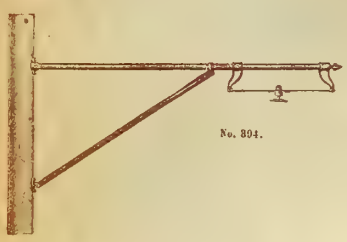

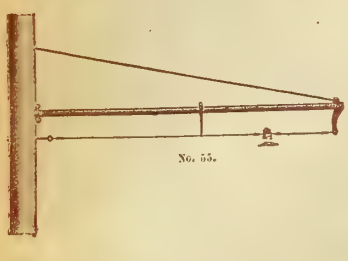

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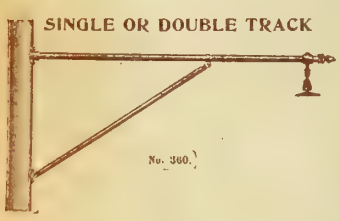

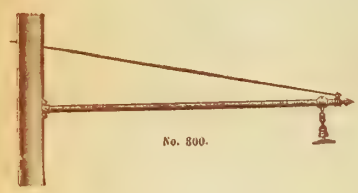

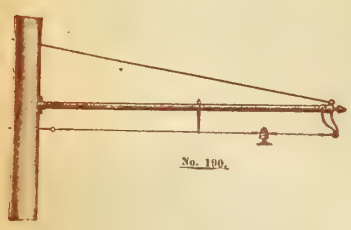

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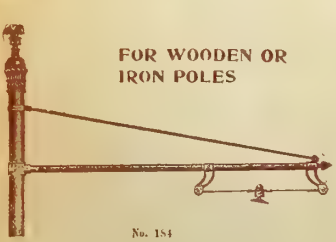

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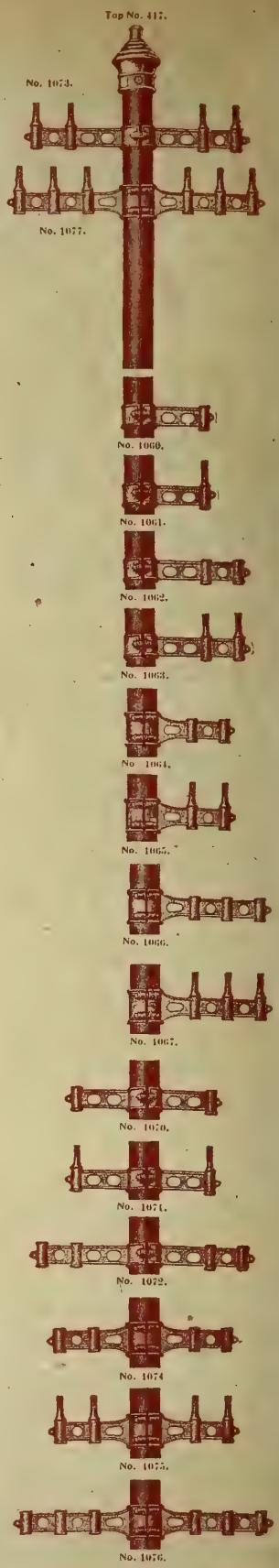

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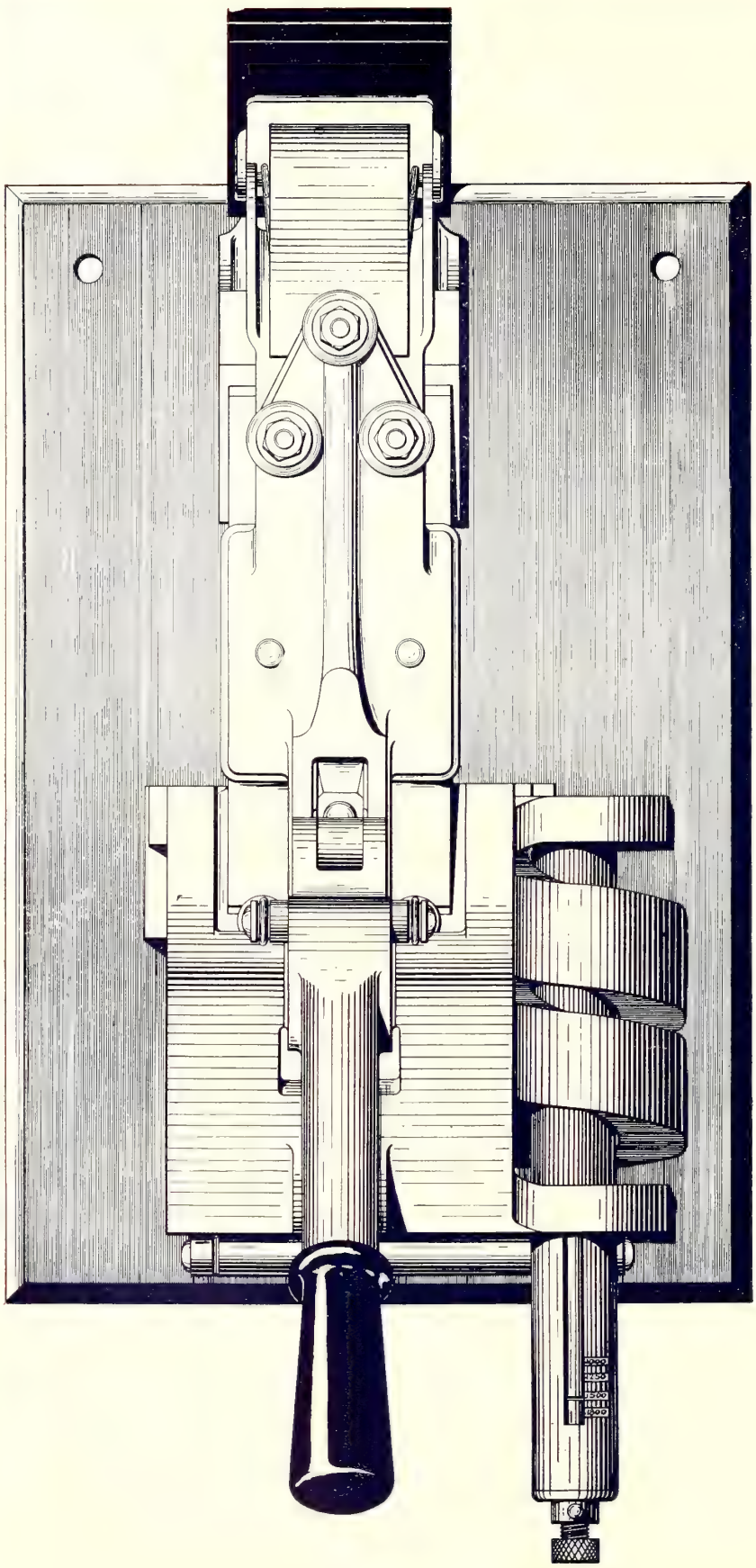

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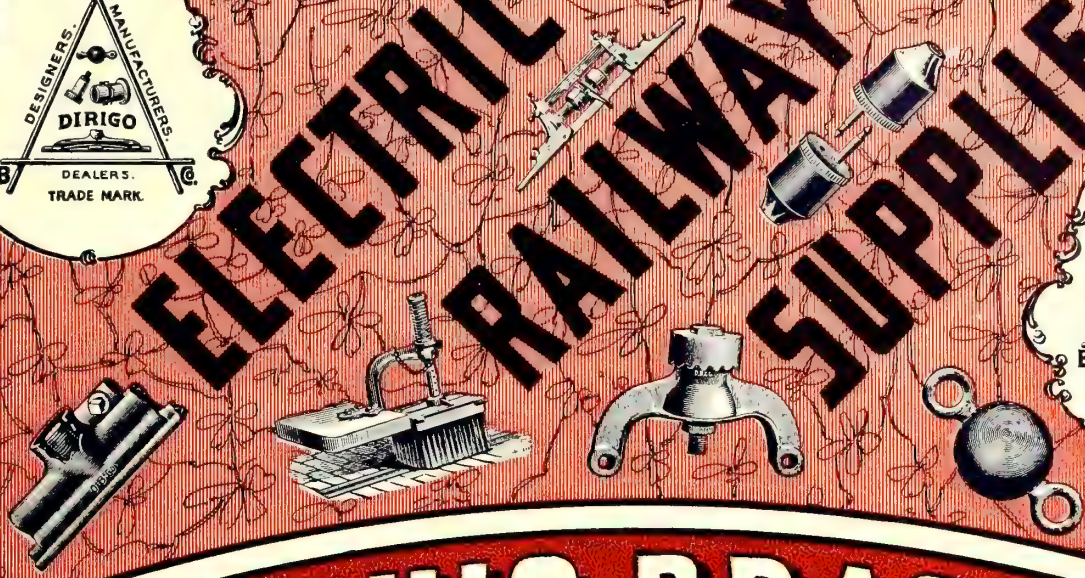

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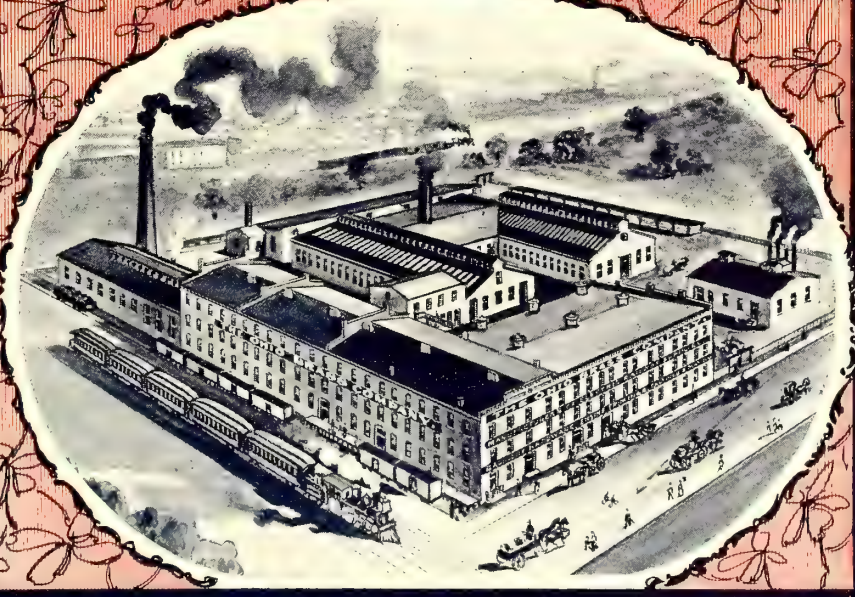

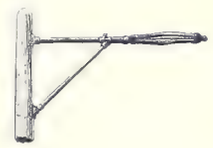

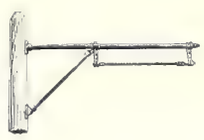

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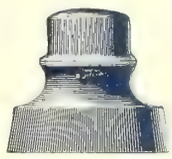
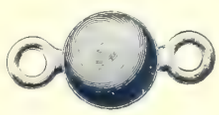

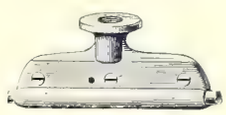
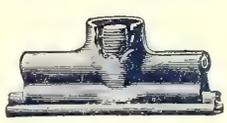
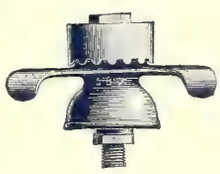
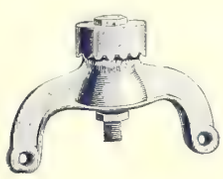

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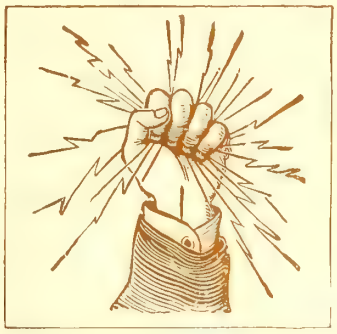

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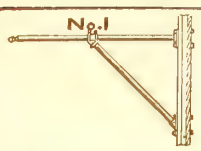

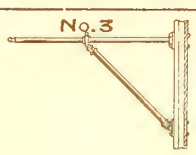

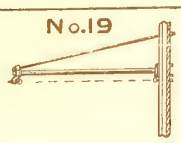

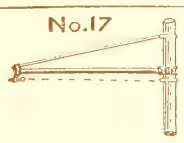

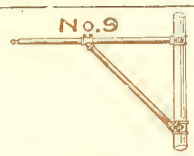

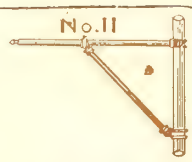

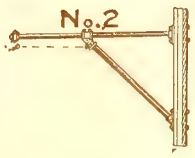

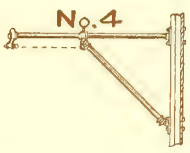

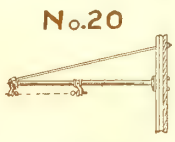

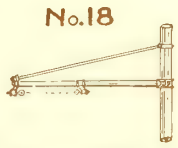

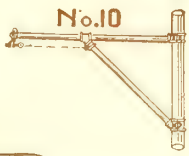

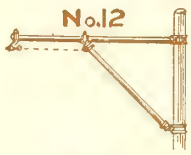

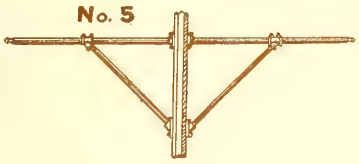

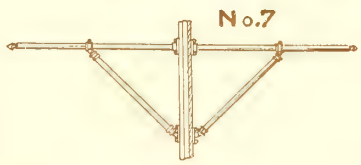

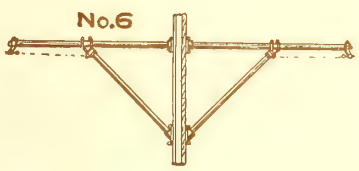

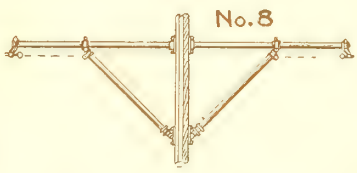

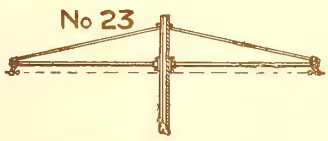

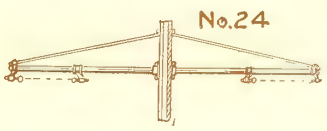

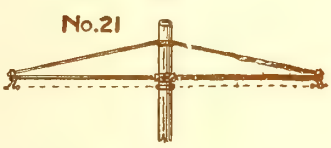

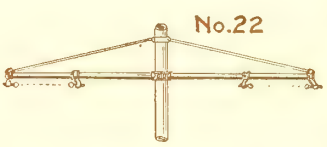

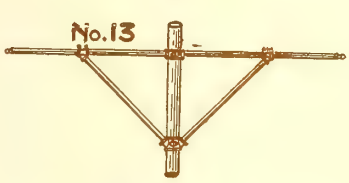

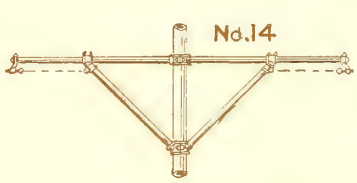

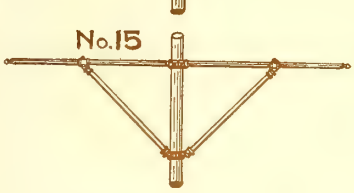

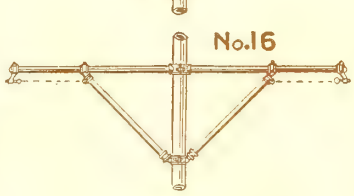

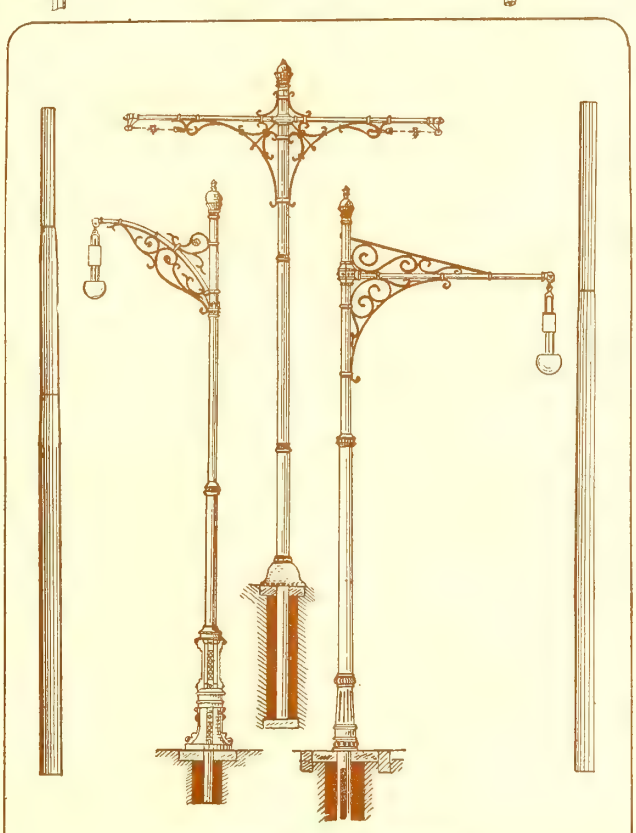
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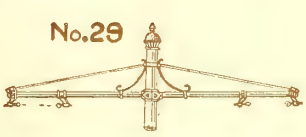

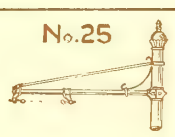

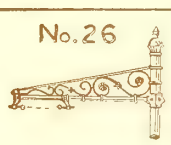

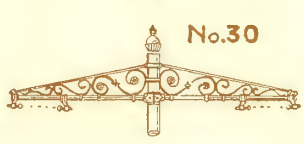

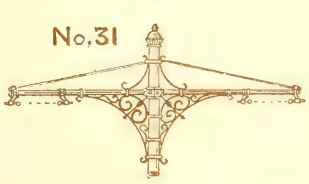

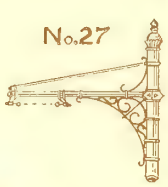

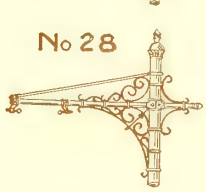

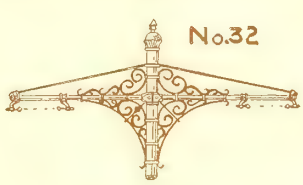

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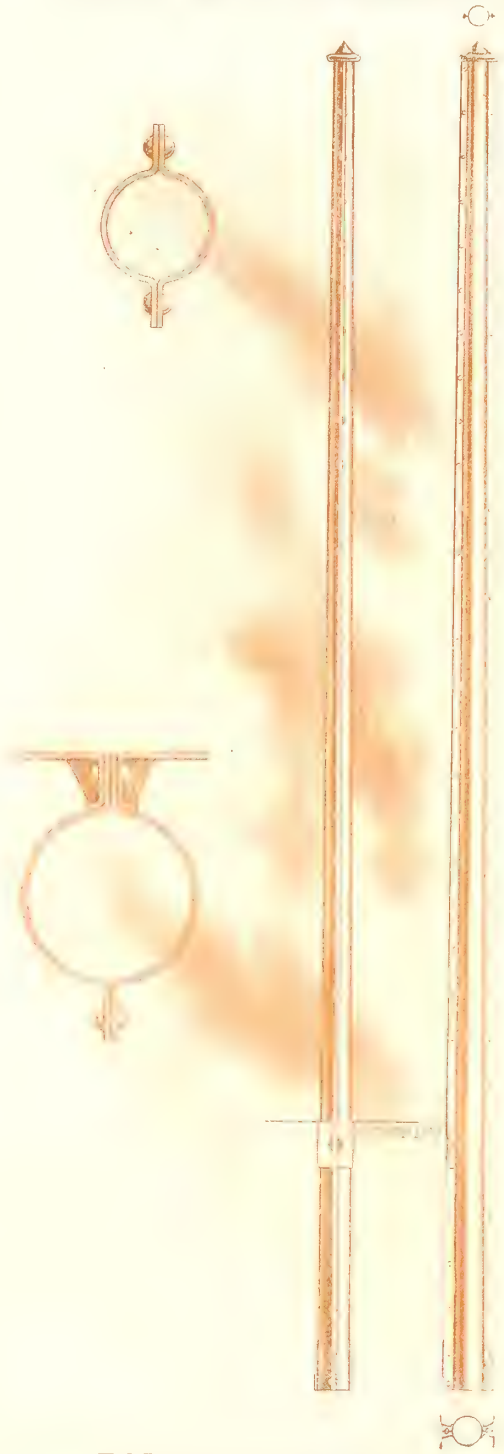

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4. It is Neat

The artistic appearance of the Pressed Steel Pole may be seen by the accompanying illustration. A handsome finish is added by the malleable or cast iron cap which covers the top of the pole.

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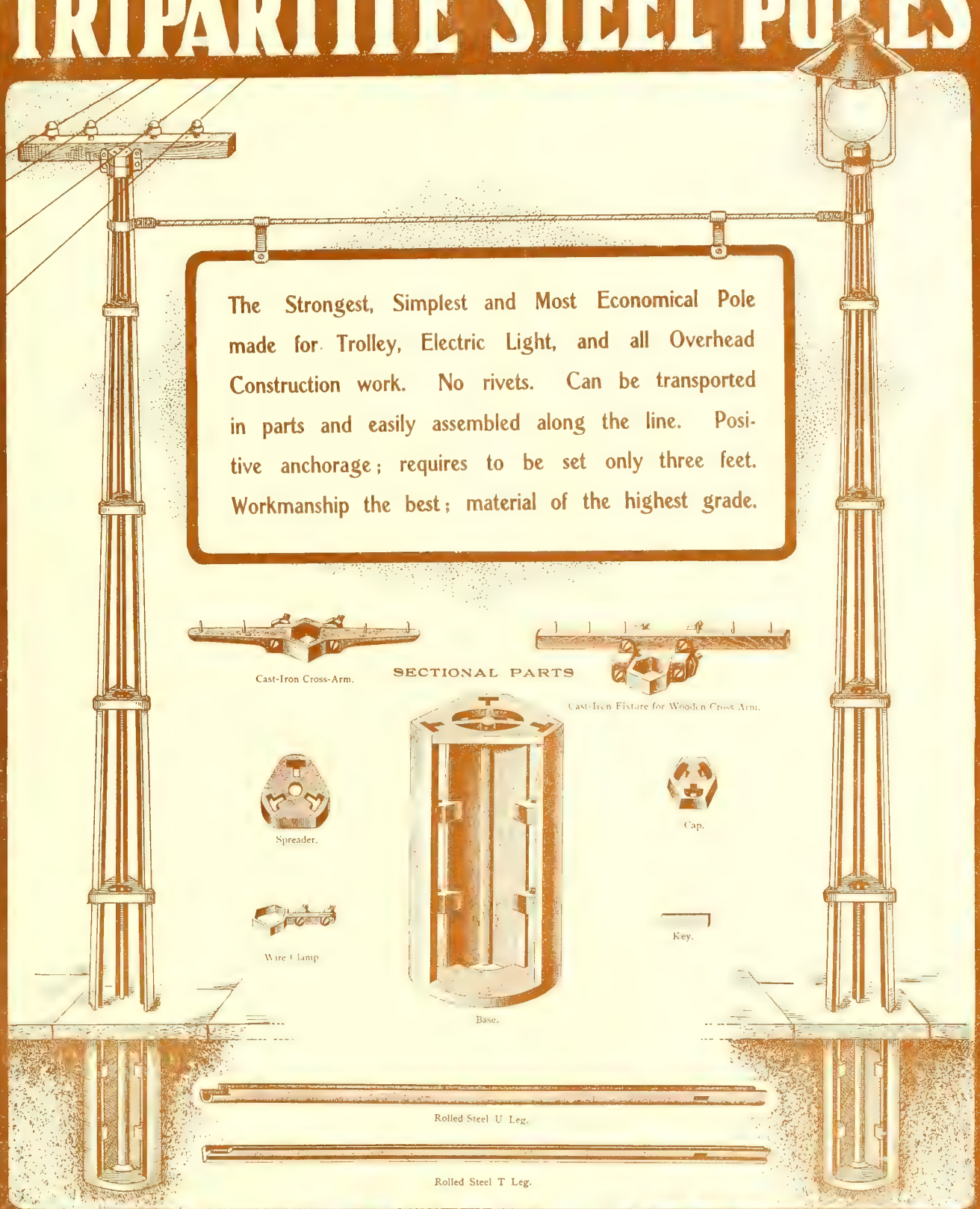

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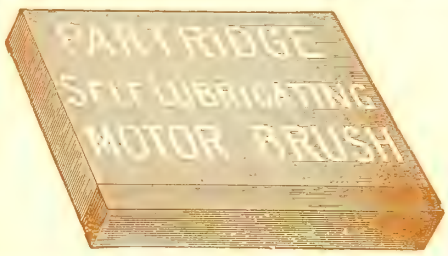

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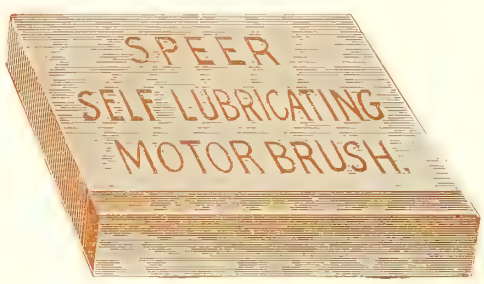

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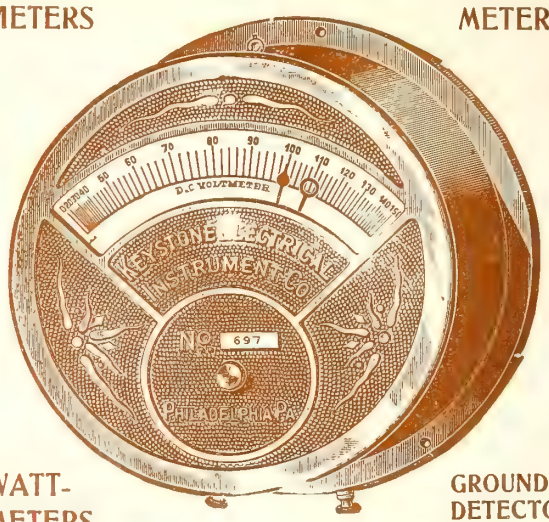

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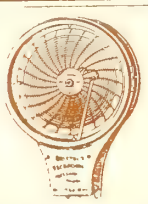

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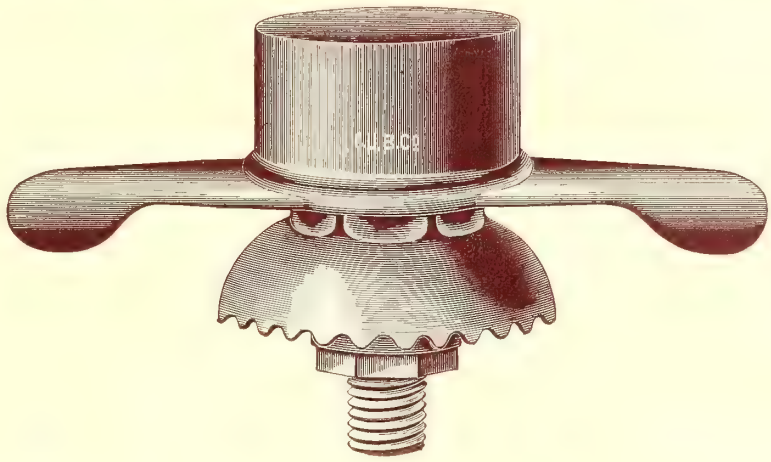

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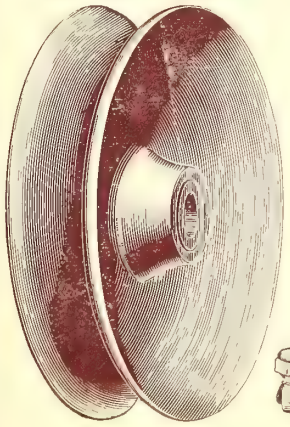

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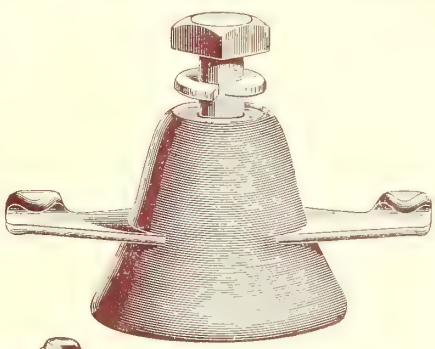

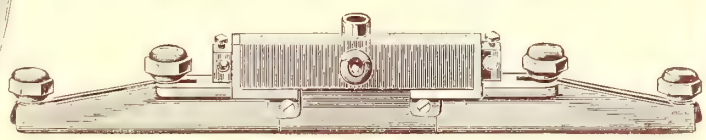

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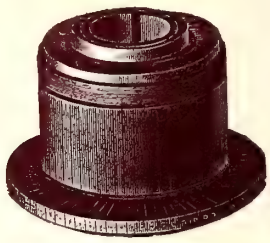

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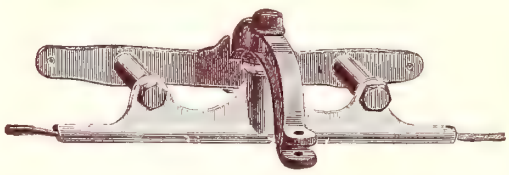

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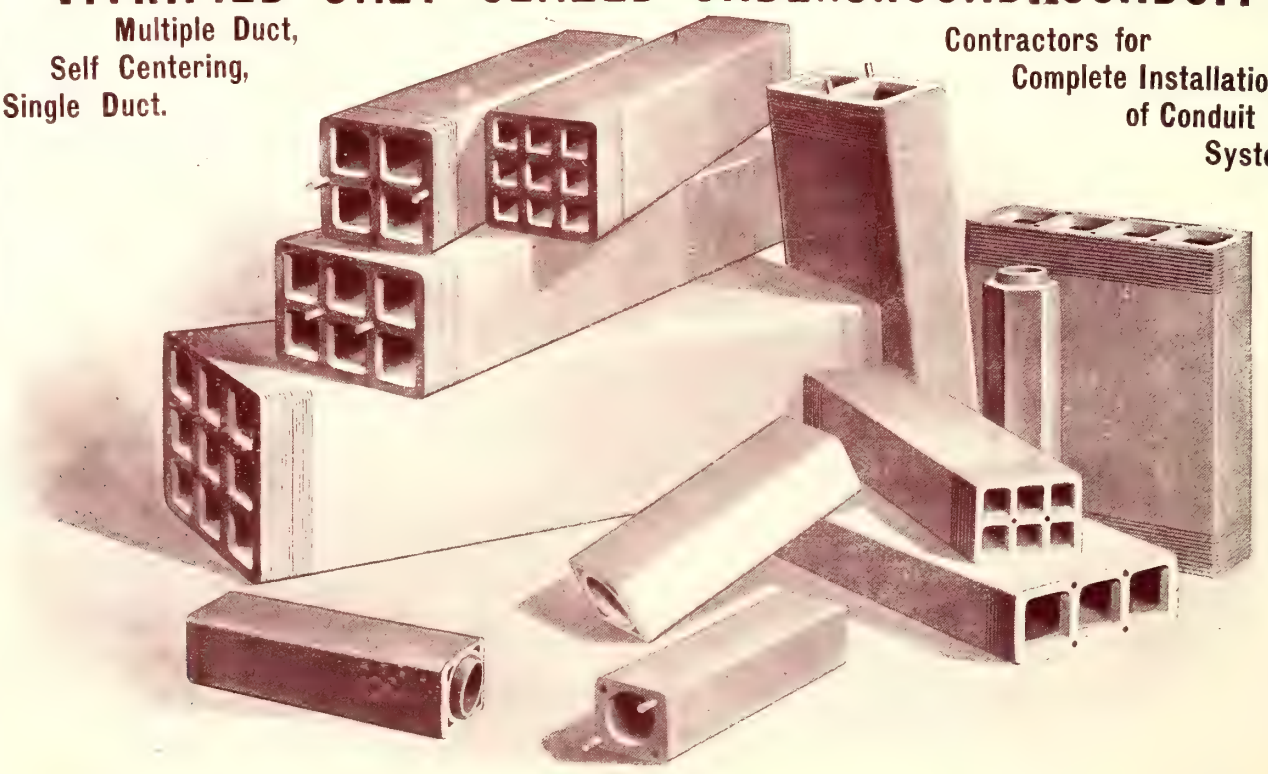

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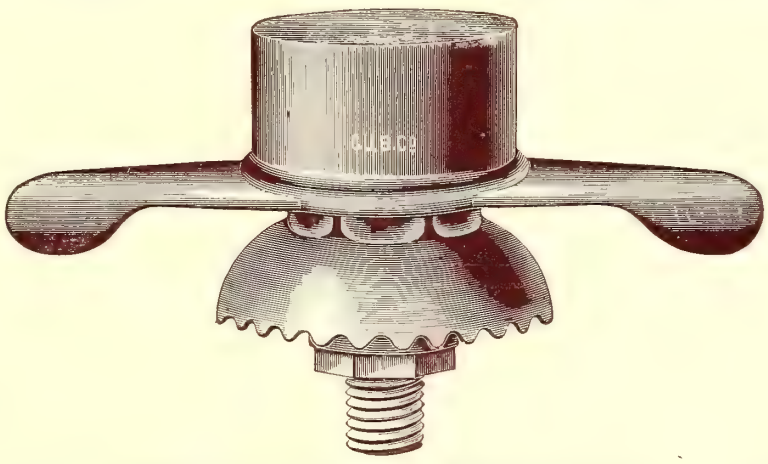

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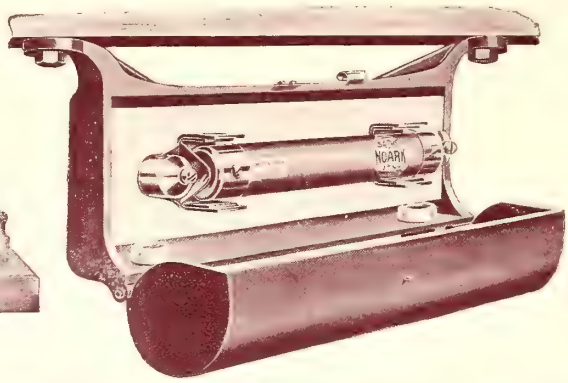

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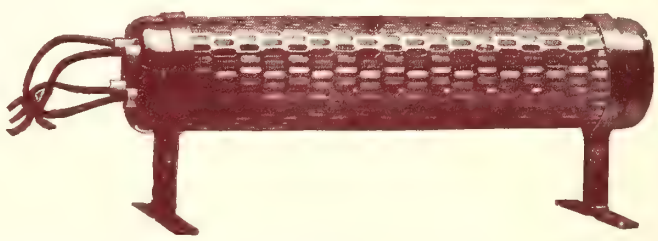

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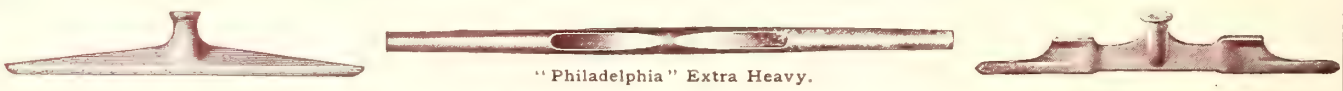

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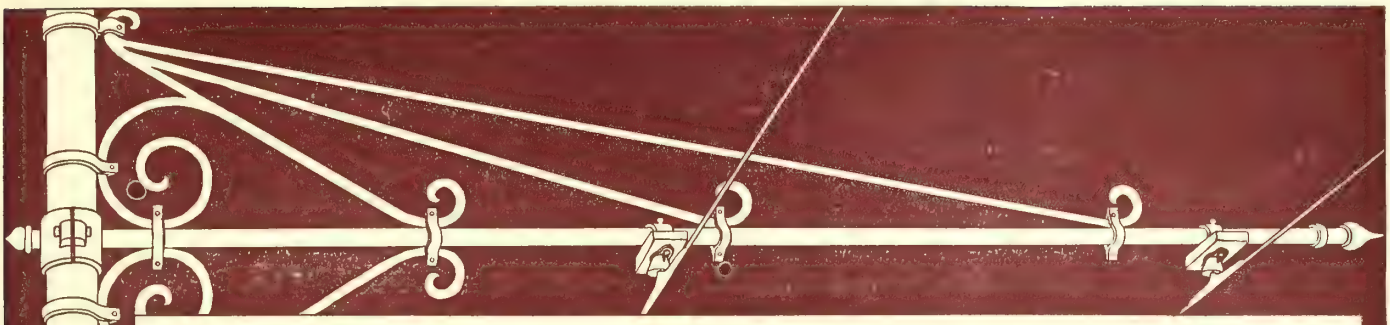

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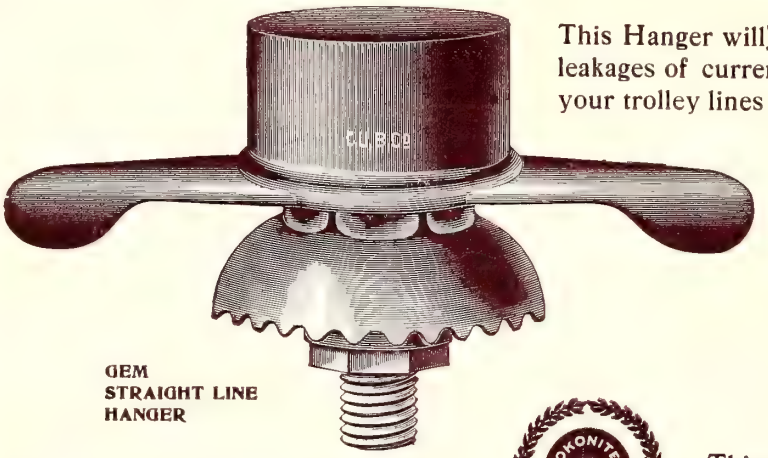

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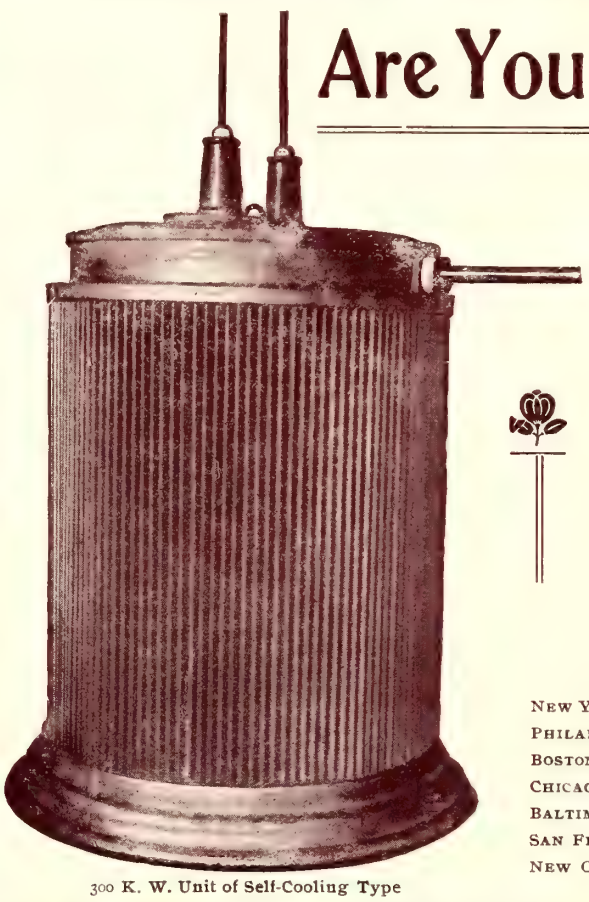

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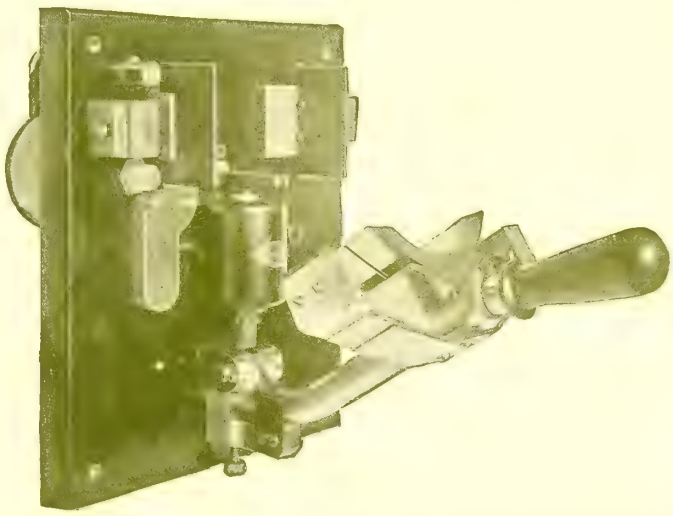

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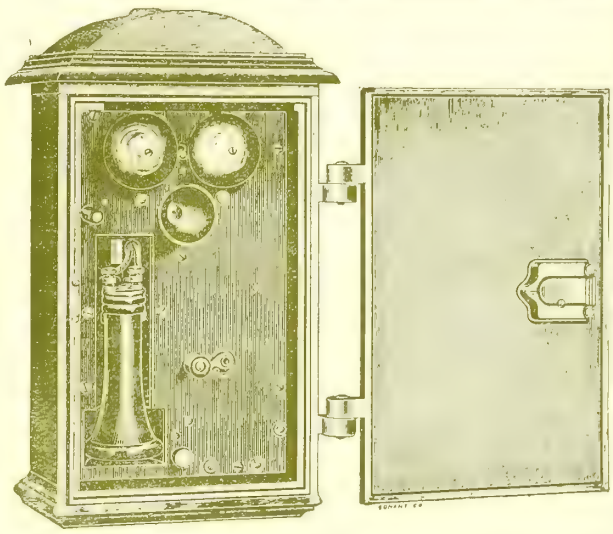

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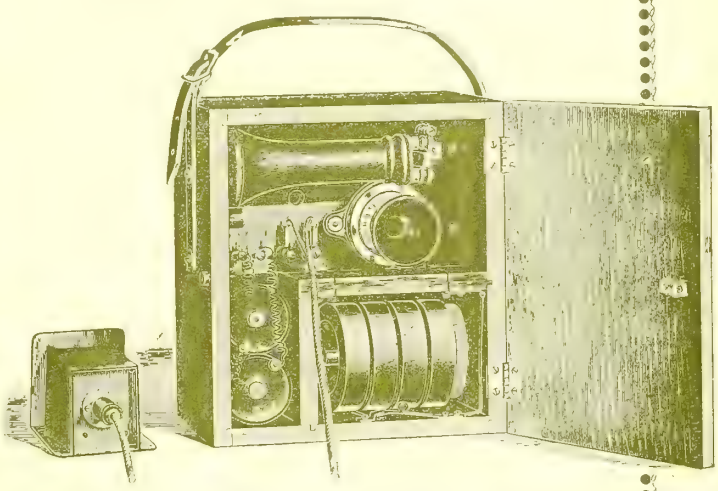

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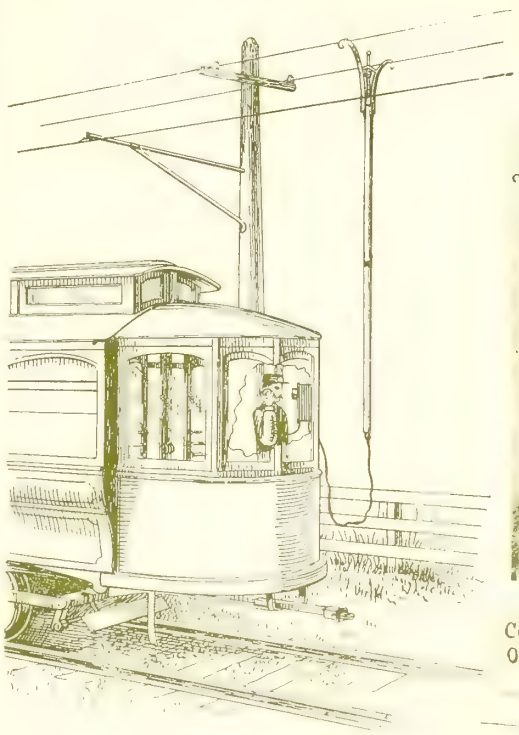

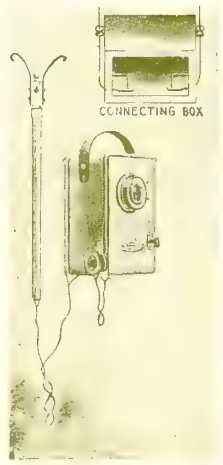

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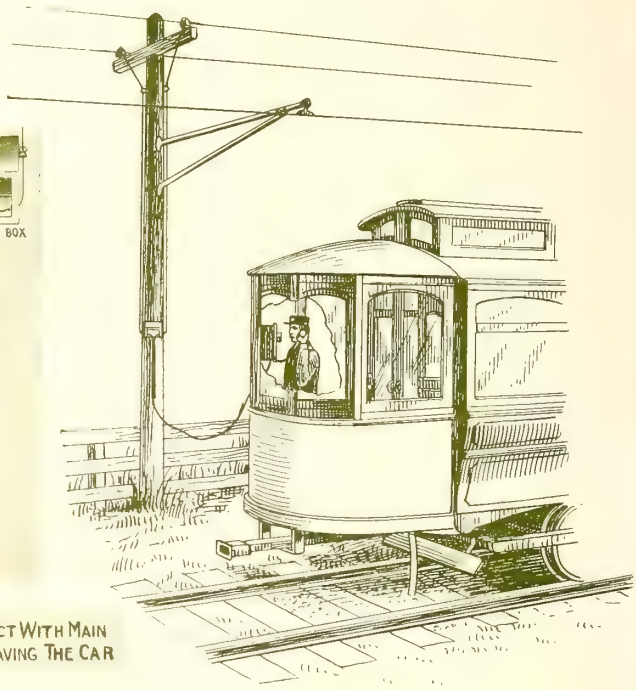

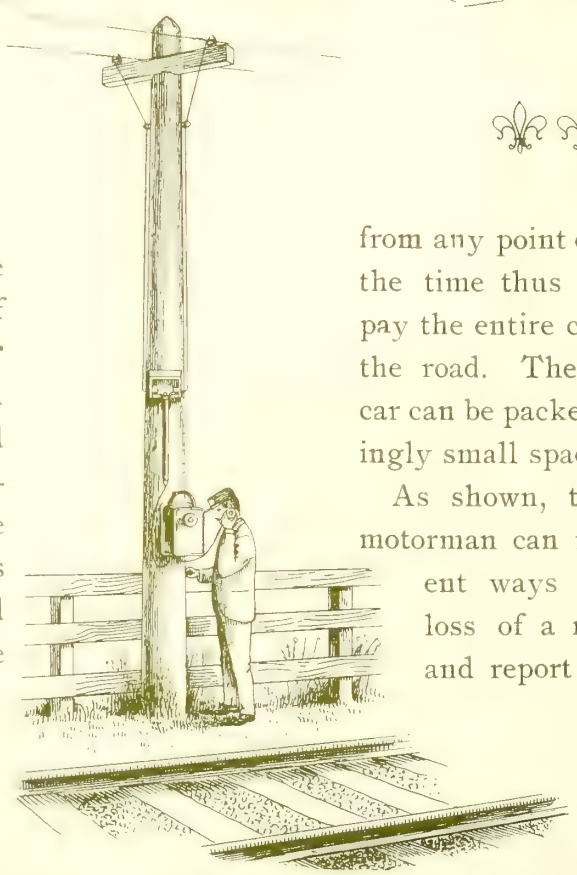

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October, Nineteen Hundred

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...AIR COMPRESSORS...

You will find these compressors useful for a variety of purposes, more numerous than we can briefly state, but the principal ones are as follows:

They furnish compressed air for blowing out dust from motors mounted on car trucks, for blowing out dust from generators in the power house, for blowing dust out of car cushions, for sand blasting and cleaning rusty iron, for white-washing and painting car barns by means of compressed air, for operating air lifts and hoists, for lifting car bodies or trucks, for air jacks arranged either on a truck to wheel about or arranged on a track in the pit. We manufacture both air hoists and air jacks in all varieties. You will also find the portable air compressor useful in drilling holes for bonding your rails. By connecting a fish pole with the trolley wire and making a ground connection with the wire and coupling your air drill to the tank on the truck, you can then drill the holes for the bonds much quicker than in any other way. You can also use this compressor to advantage in connection with the oiling system of your engines and generators by elevating the oil up to the level of the filters. For chipping and riveting hammers, and in special work where air drills are very convenient and much quicker than ratchets.

The portable air compressing apparatus, up to and including size D-4 compressor, is of suitable weight so that the truck can be hauled around by hand and can therefore be used in car barns and shops where air hoists and compressed air tools are installed, thereby avoiding the necessity of an expensive system of air piping.

Table Showing Dimensions, Weights, Etc., of Christensen Motor Compressors

Type.	No. of Cylinder	Cylinder Size, Inches	Cubic Ft. Free Air per Minute	Armature Speed	Dimensions			Weights			Telegraph Code
					Length, Inches	Width, Inches	Height, Inches	Net	Boxed for Shipment		
									Domestic	Foreign	
AA	2	5 x 2½	11	1350	21 3/16	18 5/16	17¼	446	513	593	Mabal
B	2	6½ x 3	20	1100	28 1/16	21 5/16	21⅜	785	863	953	Mabbot
C	2	7½ x 4	35	1150	32¼	24⅛	23 7/16	1080	1195	1325	Mabced
D	2	8½ x 4	47.6	1100	35 7/16	25	25⅛	1198	1325	1460	Mabdek
E	2	8½ x 7	75	1125	39¾	35¾	37⅝	1380	1530	1680	Mabesn
F	2	8½ x 10	100	975	42	38	41½	4600	4800	4900	Mabfry
G	2	8½ x 14	150	900	45	42	43	4850	5000	5200	Mabgend
H	2	12 x 10	200	850	58	43	46¼	5000	5200	5400	Mabhok
I	2	12 x 12	250	800	60	50	49	5500	5900	6200	Mabing
J	2	12 x 14	300	700	60	54	51	8900	9400	9800	Mabjuck
K	2	14 x 12	350	650	64	58	55	10000	10500	11000	Mabkik
L	2	14 x 14	400	600	64	62	58	14000	14800	15600	Mablong
M	2	16 x 14	500	500	70	62	60	16800	17400	18000	Mabmon

General Offices and Works:
720 to 738 HANOVER STREET
New Works and Foundry:
PARK PLACE and the RIVER

New York Office: 135 Broadway
F. C. RANDALL, Manager

Christensen Engineering Company

MANUFACTURERS OF AIR BRAKES

MILWAUKEE, U.S.A.

Cable Address "C. C."

EUROPEAN REPRESENTATIVES:
R. W. Blackwell & Co., Ltd.
59 City Road, London, E. C.
50 Boulevard Haussmann, Paris
W. A. PARKER,
Mgr. European Dept.
Care R.W.BLACKWELL & Co., Ltd.

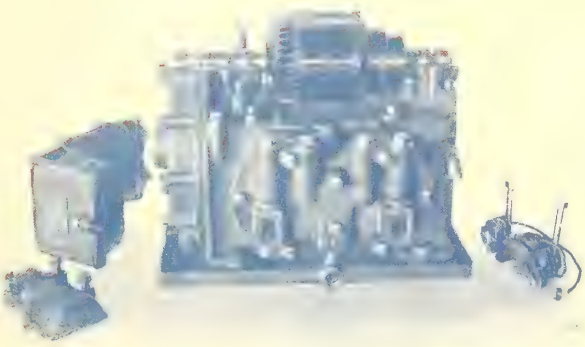
See also pages 67 and 203.

...Christensen Air Brakes...

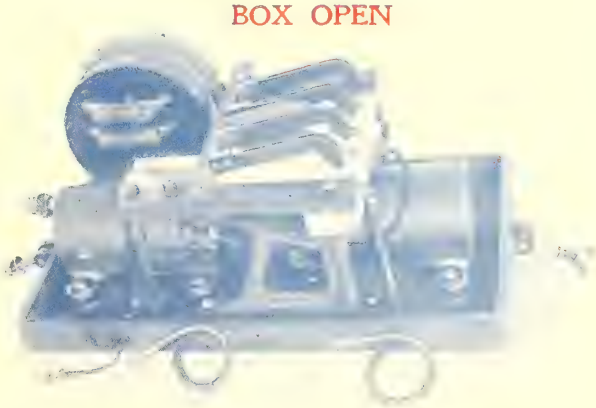
INSTRUCTION EQUIPMENT

BOX CLOSED

BOX OPEN



READY FOR REMOVAL OF ARMATURE



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See plan pages 67 and 202.

THE G. P. MAGANN STORAGE AIR BRAKES

The Railroad Commissioners of the State of New York

In their official report on their tests of Street Car Brakes, state that the reliability of the Air Brake has been thoroughly established by its use on Steam Railways and assert of air brakes, and no other class of brakes, that:

"The Air Brake, as applied to electric cars, is a reliable, powerful, quick and easily controlled means of applying the braking power to a car wheel,"

and assign to the C. P. MACANN AIR BRAKE the FIRST PLACE OF MERIT of all air brakes.

Initial cost of system moderate; works perfectly, and maintenance account—from experience of more than two years—has not been one dollar. Holds under all conditions, and will brake any car as light as a horse car or as heavy as a Pullman.

The G. P. Magann Air Brake Co., Ltd.

"THE ONLY STORAGE AIR BRAKE SYSTEM."

HEAD OFFICES:

46 and 47 Campau Building, DETROIT, MICH.

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SIMPLICITY SIMPLIFIED

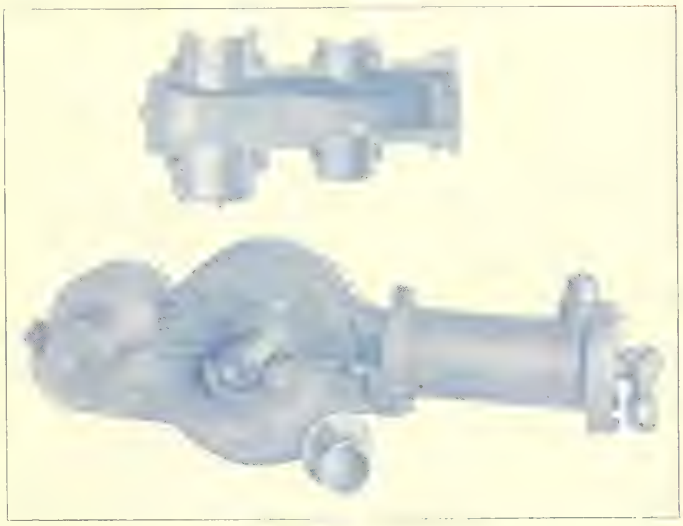
Before you decide which brake to buy, do not fail to investigate the reasons why you should adopt none other than the

KNELL AIR-BRAKE SYSTEM

Our Geared Axle-Driven Compressor System of Air-Brake is adapted for all kinds of high-speed interurban and ordinary city service. A demonstrated success in practical operation. Endorsed by some of our leading railroads.

Here are a few points of advantage :

1. ***Its Simplicity.*** There is nothing about it to get out of order.
2. ***Durability.*** All wearing parts run in oil, securely protected from dust and dirt.
3. ***Weight.*** Less than any existing Air-Brake in the market.
4. ***Constant Supply of Air*** at full pressure.
5. ***Positive*** and ***Instantaneous*** release of brakes under control of the motorman at all times.
6. ***Noiseless.***



A more detailed description will be found elsewhere in this issue.

Send for our new catalogue, which will explain to you why you should adopt no other brake.

We will meet you at the Kansas City Convention ...Oct. 16, 17, 18, 19

THE KNELL AIR-BRAKE CO.

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Standard Air Brakes

That's what a brake is for. One that cannot be depended upon to reduce speed or bring the car to a complete stop whenever and wherever desired, is perhaps the most expensive and dangerous investment you could possibly make. Standard Air Brakes can always be relied upon at the critical moment. One serious accident averted by their use will often equal the cost of a complete installation. The inventors of the "Standard" were the first to adopt the air brake principle to electric railway use, and the results of long experience

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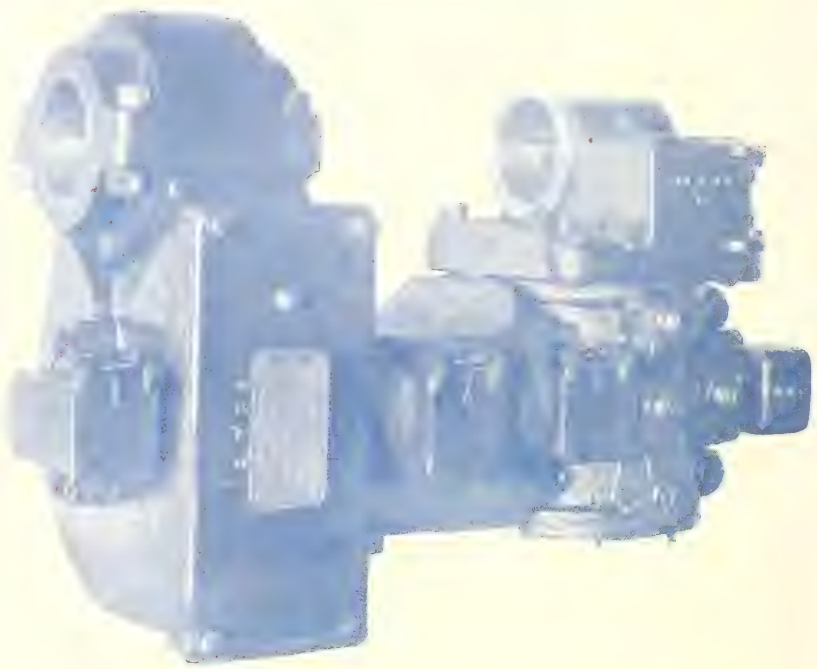

1. Adapted to the maximum speed of interurban trolley roads.
2. Maintains automatically maximum air pressure for every stop, and the compressor operates only as needs require, and at other times remains at rest.
3. The average horse power per car mile will not exceed one-eighth of one horse power.
4. Instantaneous application of the brake and no waste of air; a quicker release of the brake than in any other system.
5. But six inches of axle space between motor and hub of wheel necessary.
6. No stuffing boxes used, hence no chance for leaks.
7. The piping reduced to the minimum.
8. Few parts and so constructed that cost of maintenance will be nominal.

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Will Stop Your Cars

have enabled this company to bring every detail of the system to a perfection attained by no other apparatus of the kind. The Standard Air Brake Company builds both automatic and direct systems, with air supplied by either independent motor driven or axle-driven compressor. A knowledge of the characteristics of your road will enable us to determine which type is best adapted for your requirements. Our illustrated catalogue may also be of service to you.

Motor-Driven Compound Compressor

Especially adapted for elevated trains and heavy electric service generally. Slow speed and low gear ratio, together with uniform load on cranks and entire absence of shocks when passing centres, insure quiet running and long life. Dust and rain proof, self oiling, and built to last for years. Of much higher efficiency than single stage compressors. This type is our standard for heavy service.

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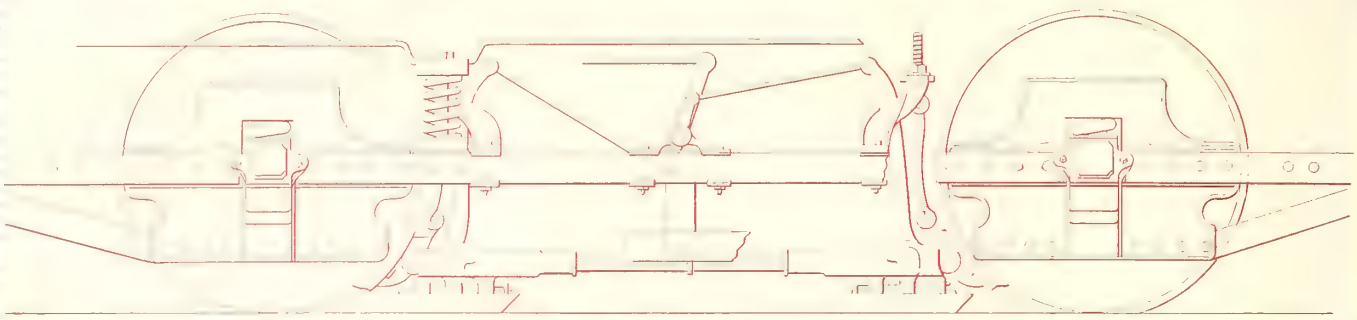
A COMBINED TRACK AND WHEEL BRAKE

The Rote Brake is a practical departure in methods of stopping street cars. It meets all the requirements of safety, economy, simplicity and ease of operation. It will prevent at least 75 per cent. of the accidents now resulting from inefficient brakes. : : :



The Rote Brake consists of shoes on the wheels and track, so constructed that contact is made with both wheels and track at the same time. After the brake is applied the pressure is automatically taken from the wheels and put on the track, thus preventing the wheels from sliding and becoming flat, and making it possible to handle the car with ease on a gummy or greasy rail. Will operate perfectly on switches, curves and cross-overs. Can be applied to any truck; is easy to adjust and keep in repair, and does away with sanding of tracks. :

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If you are interested in power brakes, you will do well to enquire into the merits of the....

NEAL--JUPITER BRAKE

which is the cheapest and simplest power brake on the market, and meets every requirement of a power brake.

UNITED STATES STEEL CO.,

145 OLIVER ST., BOSTON, MASS.

For description see page 753 in American Edition of STREET RAILWAY JOURNAL for August, 1900, and page 33 of International Edition.

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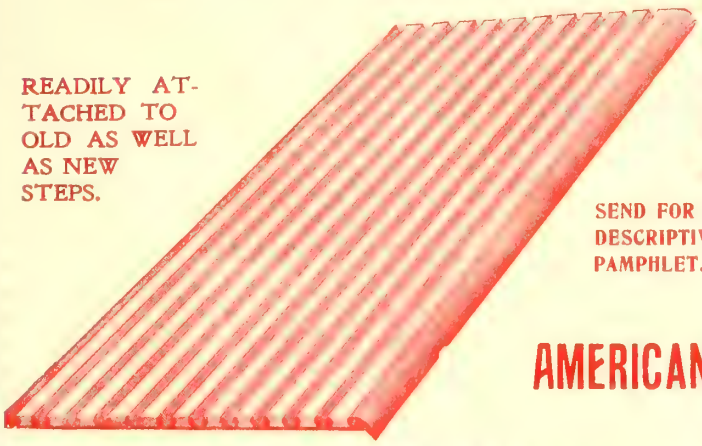
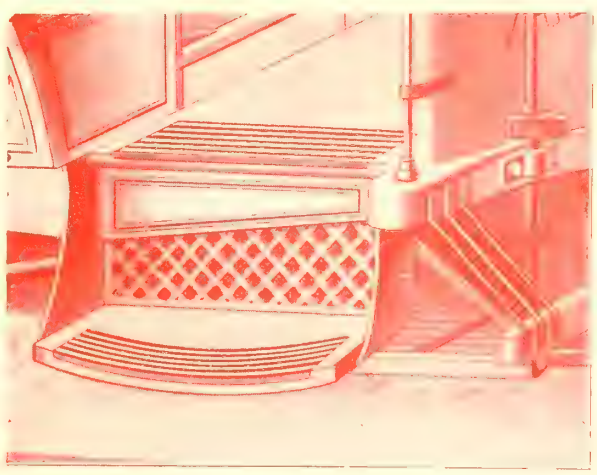
FOR CAR STEPS.

Non-Slipping.
Unwearable.

Equally efficient dry or wet, or even when covered with frost or light snow.
Treads cut to any length and width.

READILY ATTACHED TO OLD AS WELL AS NEW STEPS.





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Many Companies have adopted MASON SAFETY TREAD for all their cars.
An entire road may be thus equipped for less than the possible cost of one accident caused by a slippery step.

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All that needless expense which comes by a loose, uncontrolled trolley rope on your cars—why not cut it off? The

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SEE ALSO PAGES 68 AND 264...

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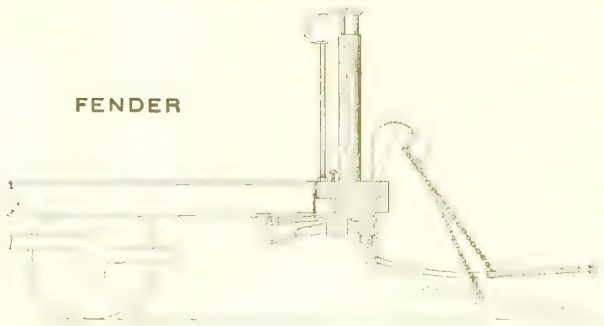
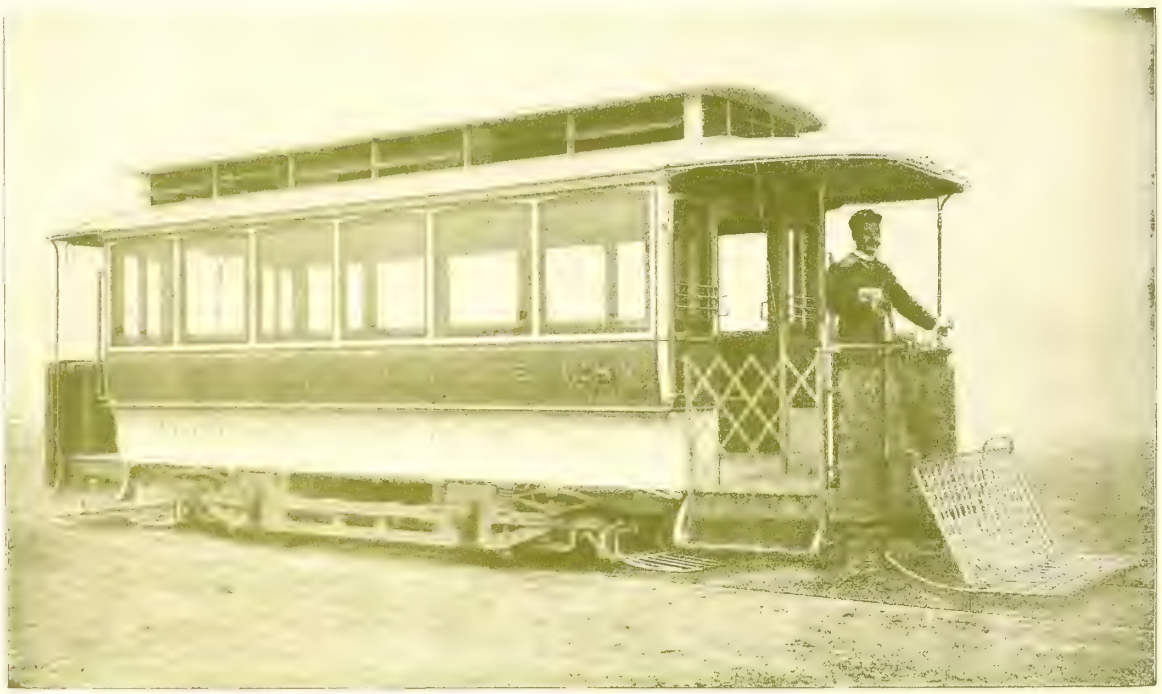
...LIFE SAVING DEVICES NEVER KNOWN TO FAIL...

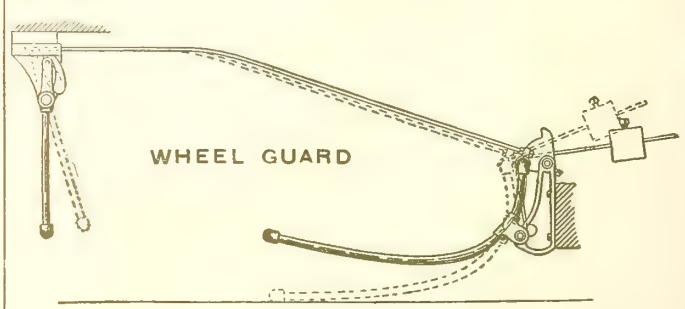


CAN BE DROPPED TO THE ROAD-BED BY A SLIGHT MOVEMENT OF THE MOTORMAN'S KNEE; READILY FOLDED OR TRANSFERRED FROM ONE END OF THE CAR TO THE OTHER : : : :



CAR EQUIPPED WITH PARMENTER FENDER AND WHEEL GUARDS

: : : : : THE WHEEL GUARD CAN BE USED IN CONNECTION WITH FENDERS, OR INDEPENDENTLY. BOTH ARE MADE ENTIRELY OF METAL AND BUILT FOR STRENGTH : : : : : : : : : : : : : : : :



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FOR STEAM AND STREET RAILROAD CARS.

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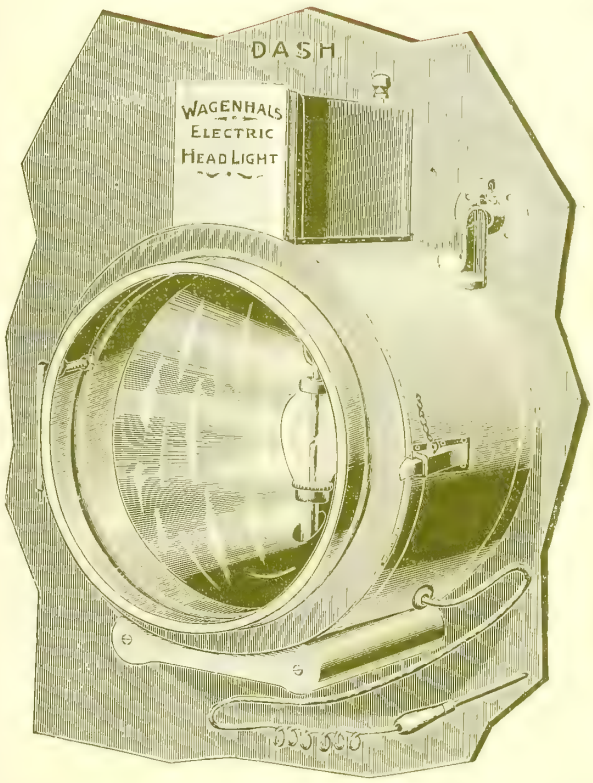
THE ONLY HEAD-LIGHT OF ITS CLASS NOW IN SUCCESSFUL OPERATION.



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PHOTOGRAPHED BY LIGHT FROM WAGENHALS HEAD-LIGHT.

MORE THAN 1400 STYLES OF OIL AND ELECTRIC **HEAD-LIGHTS.**

ADAPTED TO ALL KINDS OF SERVICE.

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ELECTRIC HEAD-LIGHT SET IN DASH.

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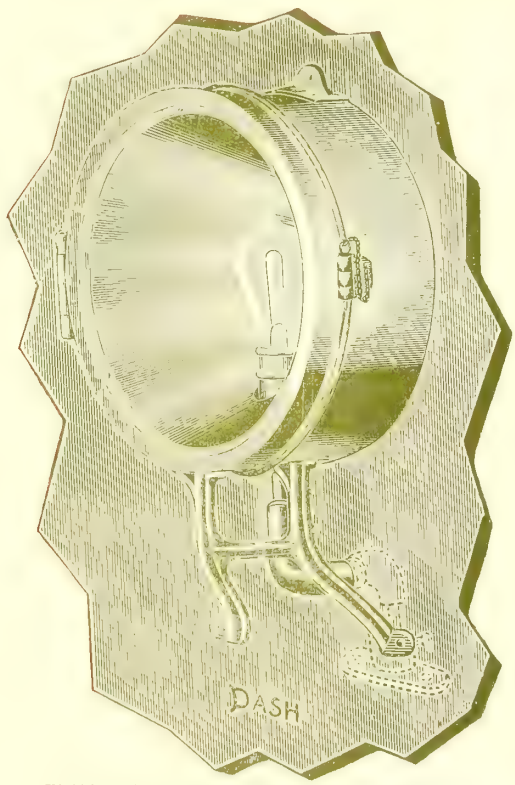
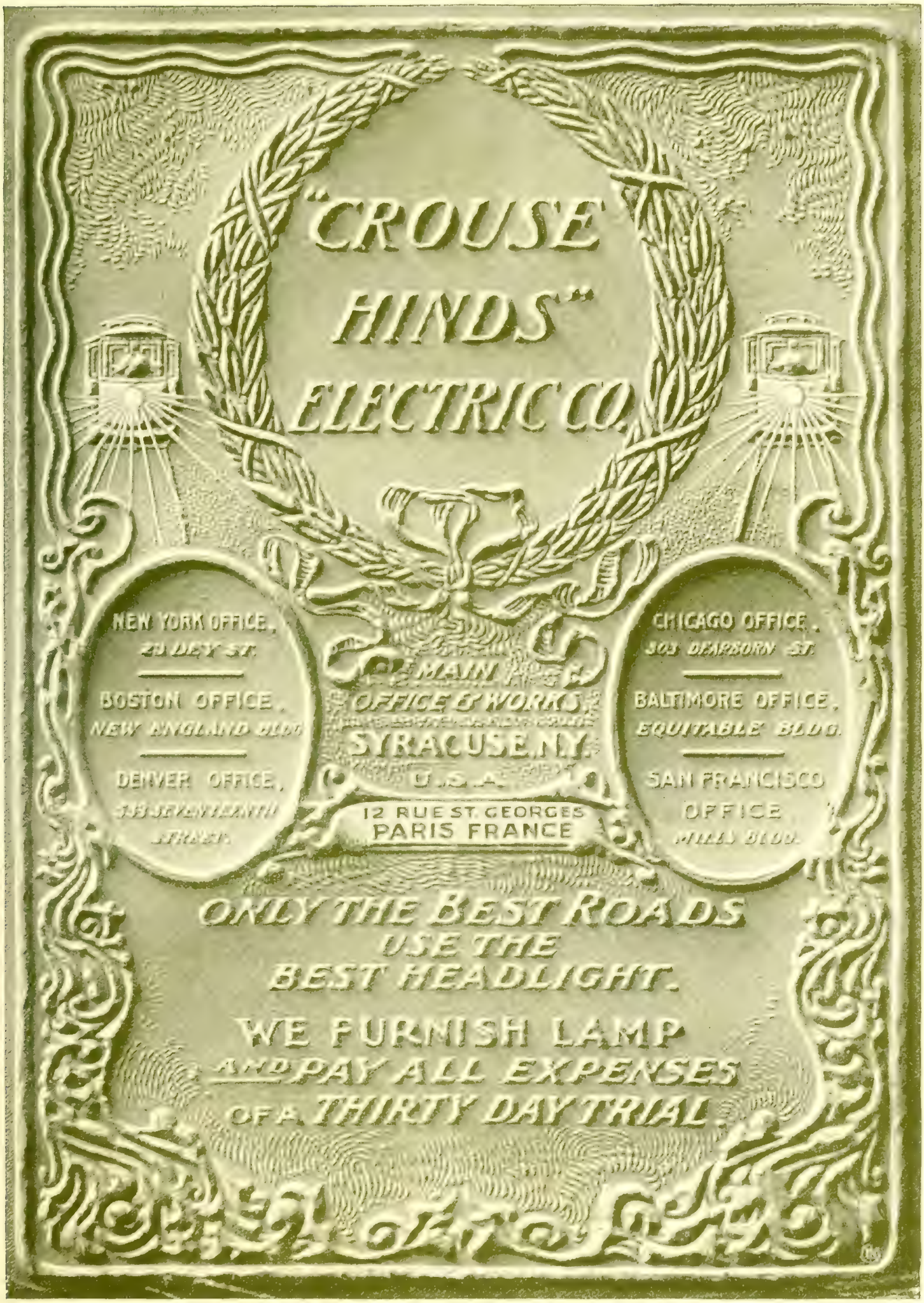


ELECTRIC HEAD-LIGHT ATTACHED TO OUTSIDE OF DASH.

THE
"SYRACUSE"
CHANGEABLE
ELECTRIC
HEADLIGHT
SYRACUSE
51
RAPID TRANSIT RY. CO
END
TO
END
CAR
TO
CAR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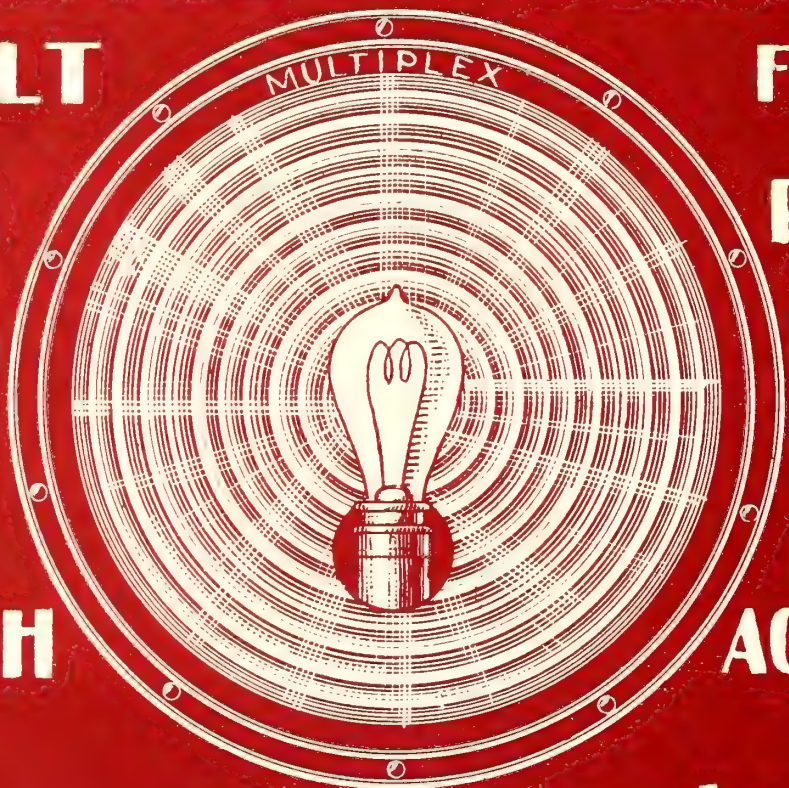
ONLY THE BEST ROADS USE THE BEST HEADLIGHT.
WE FURNISH LAMP AND PAY ALL EXPENSES OF A THIRTY DAY TRIAL.

Multiplex Reflectors

MAKE OUR HEAD LIGHTS THE MOST POWERFUL ON EARTH

BUILT FOR HOOD OR DASH



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Only perfect and successful Heater on the market. Not one authenticated failure in seven years. Over 100,000 heating coils in service. All other Heaters experimental.

The Consolidated Car Heater has already been applied to over 8,000 Street Railway Cars in this country. Standard on all the largest surface railroads in all the large cities. Adopted by the Metropolitan Street Railway of New York City, after competitive tests.

Perfect Heat Regulation; from one to five intensities and more, by means of Regulating Switches.

CONSOLIDATED CAR HEATING CO.

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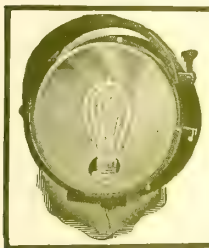

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Headlights of Every Description.

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ENAMEL CAR HEATERS AND COIL SPRING CAR HEATERS.

A variety of designs to meet all requirements. Send for Catalogue.

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ADVANTAGES GUARANTEED. Two Inches more Seat Room than any other make. Simplest Construction. No Striker Arms or Levers to injure passengers.

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Our Combination Spring Side Seating, also our Spring Edge Seating, give greatest comfort and durability.

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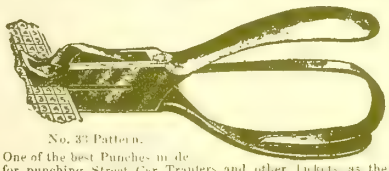
"ELEPHANT BRAND PHOSPHOR-BRONZE" INGOTS, CASTINGS, WIRE RODS, SHEETS, ETC.

— DELTA METAL —

CASTINGS, STAMPINGS AND FORGINGS.

ORIGINAL AND SOLE MAKERS IN THE U.S.

CONDUCTORS' AND TICKET PUNCHES



No. 33 Pattern.

One of the best Punches made for punching Street Car Transfers and other Tickets, as the numbers to be punched can be plainly seen through the punch.

Largest and most Complete Stock. Our punches universally used by Electric Traction and Street Railroad Companies. Guaranteed to give perfect satisfaction. Address for Complete Catalogue showing 33 different styles punches.

The Fred J. Meyers Mfg. Co.

Hamilton, Ohio. - - U. S. A

DO YOU REQUIRE BRONZE or BRASS CASTINGS, MOTOR BEARINGS TROLLEY WHEELS or BABBITT METAL?

ASK BRADY BRASS CO., 202-208 Tenth Street, Jersey City, N. J. FOR PRICES.

DANIEL M. BRADY, President. THIRTY YEARS' PRACTICAL EXPERIENCE. ADOLPH ONSLOW, Gen'l Supt.

SOLE MANUFACTURERS CYPRUS METAL.

BENT GLASS FOR RAILWAY CARS

Largest exclusive Glass Bending Works in the World.

ORIEL GLASS CO.

ST. LOUIS, MO.

....THE.....

SAFETY CAR HEATING AND LIGHTING CO.

160 BROADWAY, NEW YORK

THIS COMPANY CONTROLS IN THE UNITED STATES THE CELEBRATED

PINTSCH GAS LIGHTING SYSTEM

It is economical, safe and efficient; approved by railway managers and the Light House Board of the United States, and has received the highest awards for excellence at the World's Expositions at Moscow, Vienna, St. Petersburg, London, Berlin, Paris, Chicago and Atlanta. **105,000 cars, 4,300 locomotives** and **1,100 buoys** are equipped with this light, it being in use on 103 of the most prominent railways in the United States, and by the Pullman and Wagner palace car companies.

FOR STREET RAILWAY LINES

This system of lighting has also been adopted as the **standard light** by the Manhattan Elevated Railroad, the Broadway and Third Avenue Cable Lines of New York, the North and West Chicago and the Chicago City Railway Lines of Chicago; the Olive Street Railway of St. Louis; the Columbus Central Electric Line of Columbus, Ohio; the Metropolitan Street Railway of Kansas City, and the Denver Cable Lines of Denver, Colorado. These roads have over 3,000 cars equipped with this light.

CAR HEATING SYSTEMS

BY STEAM AND ELECTRICITY

The superior Steam Jacket System, universally used in connection with the Baker Heater.

The direct Steam Regulating System.

AUTOMATIC STEAM COUPLERS

Gold Street Car Heating Company

658 Rookery, CHICAGO, ILL. Frankfort and Cliff Sts., NEW YORK.

The "**GOLD IMPROVED ELECTRIC HEATERS**" have invariably shown the highest efficiency in delivering the warmed air into the space to be heated.

The very even graduation of the temperature and the uniform distribution of the heat at all times are especially **superior features of the Gold Electric Heaters.**

The economical consumption of current, the low cost of original installation, and the simple method of applying our electric heaters, are also prominent points of advantage, and are unequaled in any other electric heater on the market.

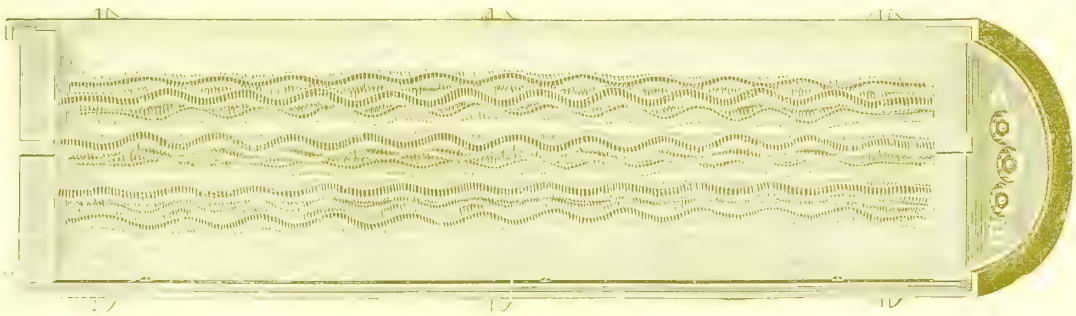
Gold's Improved (3-Degree) Panel Electric Heater.

Regulating Switch

Our new regulating switch, which is arranged for three intensities, is the simplest, cheapest and best made.

The Gold Electric Heaters

always maintain their original condition in every particular. There is no possibility whatever of the wire corroding, burning out or short circuiting, and above all else they do not increase in consumption of current with usage (a very detrimental feature and one that shortens the life of some other types of electric heaters).



Interior View of Gold's Improved (3-Degree) Panel Electric Heater.

We Challenge Comparison

of our Improved Electric Heater with any other on the market, in the following very essential features:

Efficiency

in every particular, with regard to the amount of heated air delivered into the car body, and the even and thoroughly uniform manner of its distribution.

Economy

in consumption of current, in first cost of the heaters, cost of application, and in cost of maintenance.

Simplicity

in construction of the heaters, arrangement for connecting to the regulating switch, and installation.

Durability

There has not been one of our heaters sold which has not given entire satisfaction. We are prepared to furnish prospective buyers with a list showing where every heater we have ever made is in use to-day and giving results superior to what we promised.

Catalogues, circulars and further information cheerfully furnished.

Gold Standard Electric Heater.

BAKER HOT WATER HEATERS
FOR ELECTRIC CARS.

Type of Baker Heater used in large Electric Cars.

Positively Non-Freezing.

Cheaper, More Constant, Satisfactory and Agreeable than Electricity.

Various Sizes.

Simple but Perfect in Operation.

Hot Water Pipes run around the car and at the feet of every passenger. The Heater proper may project halfway, or be placed entirely within the vestibule, and thus keep the motorman warm, and his windows free from frost.

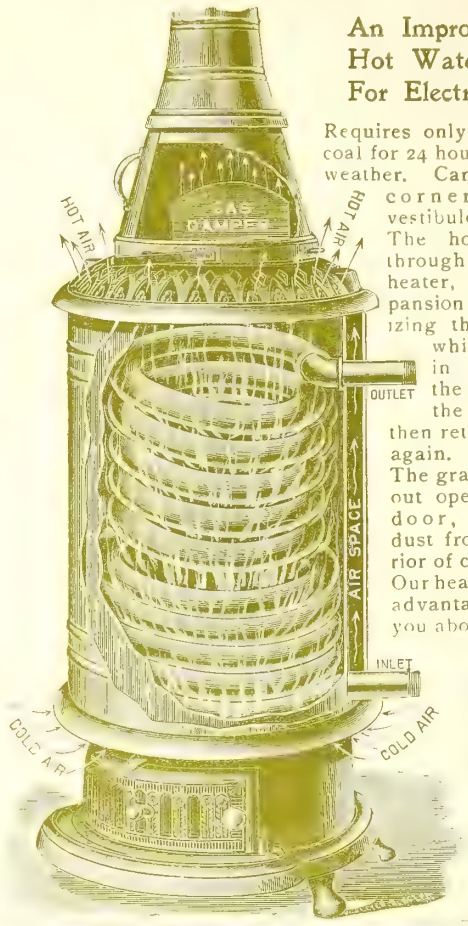
In use on the Detroit, Ypsilanti and Mt Clemens Railway Co., Ann Arbor, Mich.; Detroit, Lake Shore and Mt. Clemens Railway Co., Detroit, Mich.; Twin City Rapid Transit Co., Minneapolis, Minn; Milwaukee Electric Railway and Light Co., Milwaukee, Wis.; Waterloo and Cedar Falls Rapid Transit Co., and others.

Manufactured and Sold Only by

William C. Baker,

143 LIBERTY ST.,
New York, U. S. A.

PETER SMITH HEATER



An Improved Hot Water Heater For Electric Cars

Requires only about 75 lbs. of coal for 24 hours in the coldest weather. Can be carried in a corner of car or in vestibule.

The hot water passes through a coil tube in the heater, thence to an expansion tank for equalizing the pressure, from which point it travels in pipes throughout the car at the feet of the passengers and then returns to the heater again.

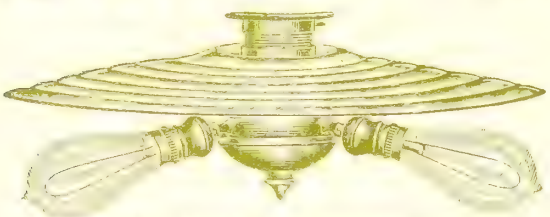
The grate is shaken without opening the ash pit door, thus preventing dust from flying in interior of car.

Our heater has many other advantages. Let us tell you about them.

Peter Smith Heater Co.

Detroit, Mich.
U. S. A.

SMITH OF NEW YORK

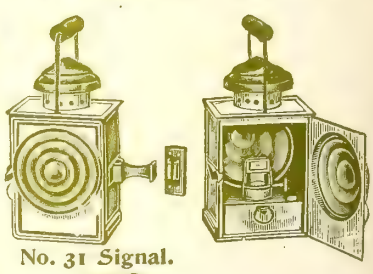


No. 51. Three Light Centre Cluster.

No. 53 Bracket.

Brass Bell Cord Couplings.

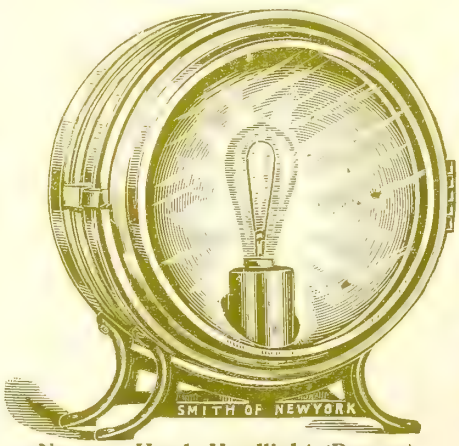
Brass Bell Cord Hooks.



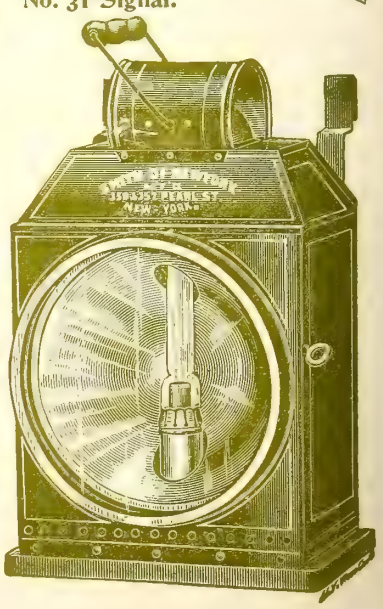
No. 31 Signal.

Smith's Automatic Torch.

No. 54 Candle Bracket.



No. 50 Hood, Headlight (Bronze).



No. 25 Oil Headlight.

Chas. G. Smith,

350 & 352 Pearl St., N. Y., U. S. A. **Lighting Supplies of All Description.**

EUROPEAN AGENT, **EDWIN LANSING, 33 King William St., London, E. C.**

COLUMBIA LAMPS.

UNEQUALED IN QUALITY.

ABSOLUTE UNIFORMITY IN CURRENT CONSUMPTION

HIGHEST MAINTENANCE OF CANDLE POWER

SPECIAL LAMPS FOR HEADLIGHTS

LONG LIFE

LARGE STOCKS PROMPT SHIPMENTS

Columbia Railway Lamp for series burning on Street Railway Circuits. Full size.

Revised Net Price List

Sent on request

We guarantee our railway lamps absolutely uniform in current consumption, thereby giving a uniform distribution of light throughout the car. The filament is unanchored, having a 2 1-2 turn coil, which gives it necessary stability and prevents any possibility of breakage from vibration.

We have been actively engaged in the manufacture of incandescent lamps for more than ten years, and therefore consider that our guarantee is worth something.

THE COLUMBIA INCANDESCENT LAMP CO.

MAIN OFFICE AND FACTORY:
1910-12-14 OLIVE ST.

St. Louis, Mo., U. S. A.

NEW YORK OFFICE: 1311 Havemeyer Building. CHICAGO: Central Electric Co.
SAN FRANCISCO: Paul Seiler Electric Works. BOSTON: 200 Equitable Bldg.
MINNEAPOLIS: 17 South Fourth Street.

Send us a trial order and be convinced that Columbia Lamps are exactly as represented

PANTASOTE!

THE ONLY PERFECT MATERIAL FOR

Car Seats, Car Curtains, Head Linings.

WATER-PROOF, GREASE-PROOF, STAIN-PROOF, GERM-PROOF.

PANTASOTE IS ENTIRELY ODORLESS, WHICH DISTINGUISHES IT FROM ALL OTHER LEATHER SUBSTITUTES

Used for six years by leading railways in America and Europe with unqualified success.

Will not rot, crack, peel, shrink, stretch or stiffen. It is not affected by heat or cold; contains no rubber or cellulose. The surface of Pantasote is non-inflammable; unlike its cellulose imitations, it **will not burn,** is never sticky, and always handsome.

Looks exactly like leather, costs half as much and endures longer. (The curtain material is a double textile with Pantasote between.)

Made in plain leather grains or richly embossed, for Seats, Panels, Head-Linings. All stamped colors in figured or plain double textile face for Curtains.

HIGHEST AWARD AT PHILADELPHIA EXPOSITION, 1899

CAUTION.—There are worthless and dangerous imitations. Genuine has Pantasote stamped on goods.

THE PANTASOTE CO., 29 BROADWAY, NEW YORK CITY.

Roads Equipped with

Hunter Signs

United Traction Co., Pittsburg, Pa.
Consolidated Traction Co., Pittsburg, Pa.
Monongahela St. Ry. Co., Pittsburg, Pa.
Pittsburg & Birmingham St. Ry., Pittsburg, Pa.
McKeesport & Wilmerding St. Ry., Pittsburg, Pa.
United Railways Co., St. Louis, Mo.
United Railways & Electric Co., Baltimore, Md.
Chicago City Ry. Co., Chicago, Ill.
Chicago Electric Traction Co., Chicago, Ill.
New York & Queen's County Ry. Co., Long Island City, N. Y.
Staten Island & Midland R. R. Co., Staten Island, N. Y.
West Side R. R. Co., Elmira, N. Y.
Elmira & Horseheads Ry., Elmira. N. Y.
Toledo Traction Co., Toledo, Ohio.
New York & North Shore Traction Co., Long Island City, N. Y.
St. Louis Transit Co., St. Louis, Mo.
Suburban Rapid Transit Co., Pittsburg, Pa.
Washington Water Power Co., Spokane, Wash.
Holyoke Street Railway, Holyoke, Mass.
Decatur Traction & Electric Co., Decatur, Ill.
Birmingham Railway & Electric Co., Birmingham, Ala.
Peoria & Pekin Terminal Ry., Peoria, Ill.
Joliet R. R. Co., Joliet, Ill.
Quincy Railway Co., Quincy, Ill.
Indianapolis St. Ry. Co., Indianapolis, Ind.
Dayton & Xenia St. Ry., Dayton, Ohio.
Orleans R. R. Co., New Orleans, La.
Charleston St. Ry. Co., Charleston, W. Va.
Consolidated St. Ry. Co., Grand Rapids, Mich.
Galveston City R. R. Co., Galveston, Texas.
Dallas Consolidated Electric St. Ry. Co., Dallas, Texas.
Elizabeth St. Ry. Co., Elizabeth, N. J.
Covington & Cincinnati St. Ry. Co., Covington and Cincinnati, Ohio.
Citizens St. Ry. Co., Muncie, Ind.
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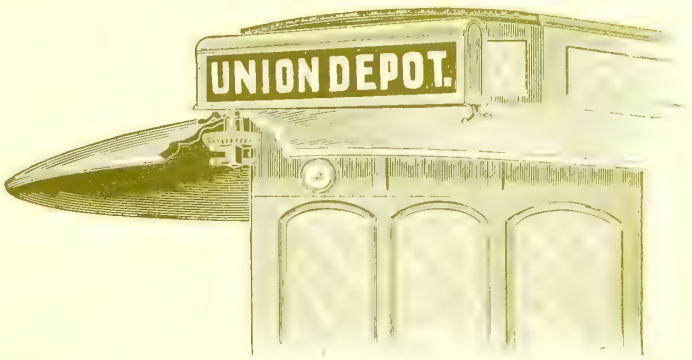


We have the only perfect sign in the market—day and night.

A trial order is solicited.

When ordering cars don't fail to specify the HUNTER SIGN...

2600 IN USE IN ST. LOUIS, MO.

The HUNTER ILLUMINATED CAR SIGN CO.

LYTLE J. HUNTER
Secretary...

Commercial Tribune Building
CINCINNATI, OHIO

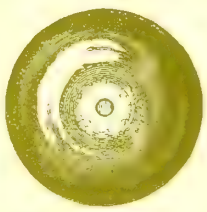
MORRIS ELECTRIC CO., 15 Cortlandt St., New York, Eastern Representative

SEAMLESS STRUCTURAL CO.,

MANUFACTURERS OF

ROLLED STEEL GONGS.

Foot Gongs and Attachments for Street Cars.



The Most Durable Gong Made.

P. O. Box 246.

WORKS, 718 to 732 HANOVER ST.,

MILWAUKEE, WIS.

PITTSBURGH STEEL HOLLOW-WARE CO.

CHESWICK, PA.

Manufacturers of

ROLLED STEEL

GONGS

FOR STREET CARS, STEAM ROADS AND STEAMSHIPS, YACHTS, ETC.

Western Representative
THE W. R. GARTON CO., 315 Dearborn Street, CHICAGO, ILL.

Goldarn ye! Can't ye hear?
"SPIRAL BEARINGS"!
SPIRAL BEARINGS!
"SPIRAL BEARINGS"!!

Better lubrication! Less liability to heat!
Less wear on Journals! Greater mileage!
Safer! Cheaper! than any other bearing!

SPIRAL JOURNAL BEARING COMPANY,
1543-1545 North 20th St. ST. LOUIS.

Every Genuine Roller has the name of manufacturer, STEWART HARTSHORN, in script on label.

Special rollers for street and steam railway cars.
Brackets suitable for all classes of fittings.
Used all over the world wherever cars are run.

STEWART HARTSHORN CO.

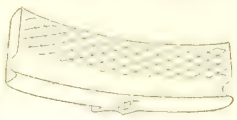
NEW YORK, 486 Broadway,
CHICAGO, 260-262 Fifth Ave.

Office and Factory,
E. NEWARK, N. J.

THE AMERICAN BRAKE SHOE COMPANY,

Owners of the Sargent and Diamond "S" Patents.

BRAKE SHOES MADE AND SOLD BY BRAKE SHOES



THE SARGENT COMPANY, Chicago, Ill.
PARKER & TOPPING, St. Paul, Minn.
RAMAPO IRON WORKS, Hillburn, N. Y

Can You Equal It?

Mileage on Axle Bearings 65,000 : : :
Mileage on Armature Bearings 43,000
That is what our metal will do : : : :

WRITE US FOR PARTICULARS

Bridgeport Deoxidized Bronze & Metal Company,
BRIDGEPORT, CONN.

MALLEABLE CASTINGS

PROMPT DELIVERIES

Submit Sample Castings and Let Us Name You Price. : :

TORRANCE IRON CO.
TROY, N. Y.

KALAMAZOO TROLLEY WHEEL

Our new method of treating copper produces a metal unequaled for this purpose—soft and long-lived.

Will run in sleet longer than any other. Self-oiling, and therefore saves bushings. Actual service proves superiority. **Will not injure wire.** Better conductor and not complicated.

THE STAR BRASS WORKS (INCORPORATED), KALAMAZOO, MICH.

ANTI-OFF YOUR TROLLEY

E. G. JOHNSON, Pres.
THOS. A. EDISON, Jr., V.-Pres.
J. W. ALLOTT, Treas.
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Edison-Johnson Electrical Manufacturing Co.
INCORPORATED

...Sole Manufacturers...

Edison-Johnson Trolley Harps

A long felt want of trolley roads supplied at last.

For all information apply to our only office....

ST. JAMES BUILDING, 1135 BROADWAY, NEW YORK CITY

See description elsewhere in this issue.

"EXCELSIOR" SELF-OILING TROLLEY HARP

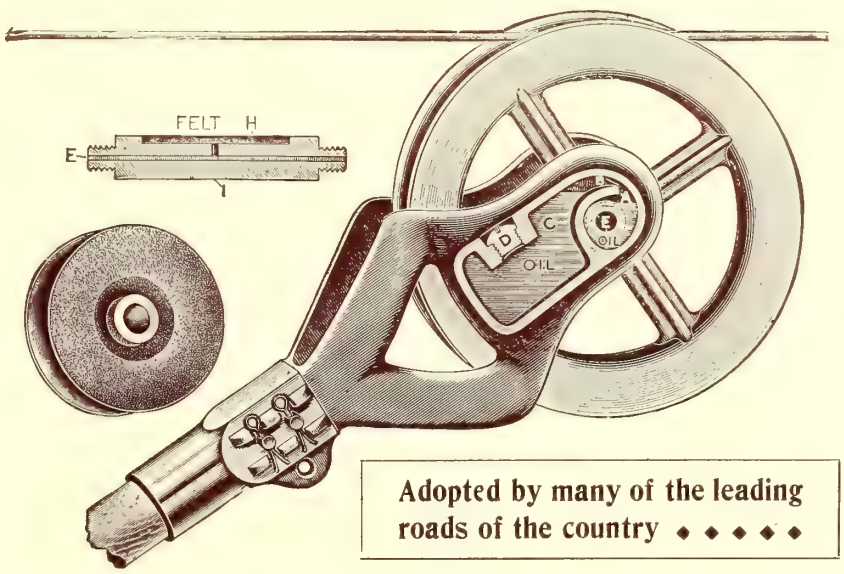
Made of Aluminum or Brass. Sizes for 4″, 5″ and 6″

WEIGHT, BRASS HARP, BRASS WHEEL

4″ - 5 lbs. 8 oz.
5″ - 6 lbs. 12 oz.
6″ - 8 lbs. 4 oz.

WEIGHT, ALUMINUM HARP, BRASS WHEEL

4″ - 3 lbs. 8 oz.
5″ - 4 lbs. 8 oz.
6″ - 5 lbs. 12 oz.



Adopted by many of the leading roads of the country ◆ ◆ ◆ ◆ ◆

TO THE ELECTRIC ROADS OF THE WORLD:

This Harp has been on the market three years, during which time it has passed through its experimental stages, and is now a perfect device. Owing to the weight of the sizes 5″ and 6″ in brass many roads were unable to use them, the trolley spring not being strong enough; but in aluminum the reduced weight renders them applicable to the springs as at present used. We ask you to send for circular, giving full description of the harp and a partial list of the many roads that have adopted them. We have but one price, as follows: 4″, $1.75; 5″ and 6″, $2.00 each. Wheels extra, prices on application, ranging from 60c. to $1.00, according to design and size.

WE CLAIM

1st. That all the oil in the reservoirs is used and not wasted, as by the present method, trying to eject a few drops between the hub and the Harp; also that, running "dead true," there is less wear to both wheel and overhead wire.

2nd. That they are noiseless and the tops of cars are kept clean if proper consistency of oil is used.

3rd. The cost of graphite bushing, "a non-conductor," is saved as well as the services of a man to oil at the end of each trip, the oil lasting from 10 to 30 days, according to conditions.

4th. That our special metal excelsior wheels have no equal.

MANUFACTURED BY

INTERNATIONAL SPECIALTY CO.

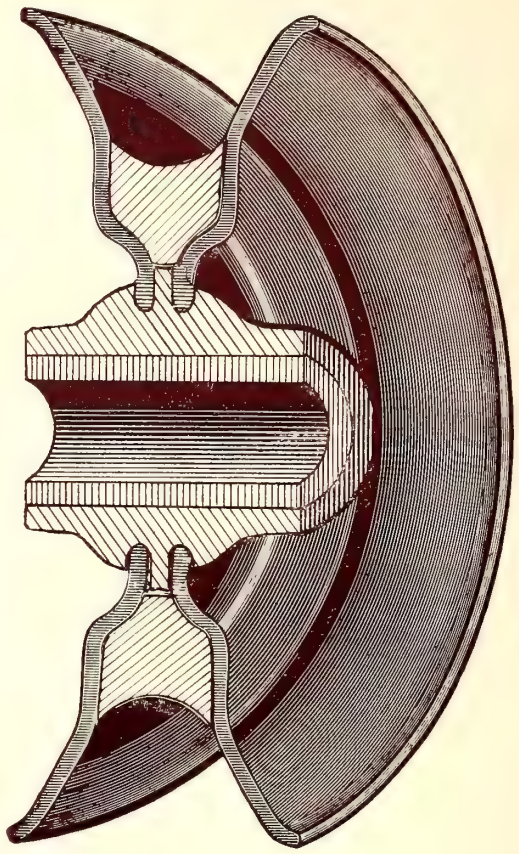
220 ABBOTT ST., DETROIT, MICH.

The Ideal Trolley Wheel

MAXIMUM { STRENGTH / LIFE

MINIMUM { WEIGHT / PRICE

DOES NOT WEAR THE WIRE



LUMEN BRONZE

For Armature, Axle and Journal Bearings.

25 per cent. lighter than ordinary bronze.
Never cuts the shaft, journal or pin.
Runs cool under pressures that crush other alloys.

THE BIERBAUM & MERRICK METAL CO.

BUFFALO, N. Y.

GILBERT'S PATENT SLEETER

FOR SALE AT A GREAT SACRIFICE

Inquire at once.

A prompt reply will secure a great bargain.

P. H. GILBERT, SCRANTON, PA.

AMERICAN STREET RAILWAY INVESTMENTS

"The Street Railway Red Book." . .

The Standard Manual of Street Railway Statistics. . . . .
EDITION OF 1900 READY FOR DELIVERY

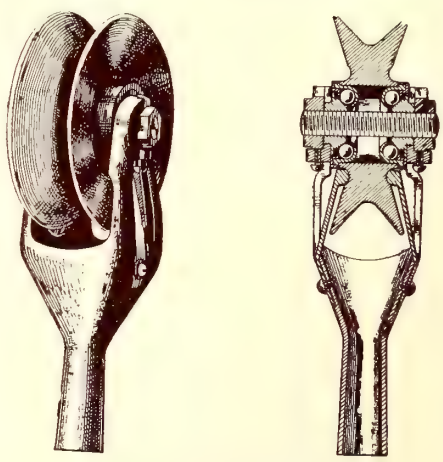
PRICE, $5.00.

STREET RAILWAY PUBLISHING CO.,
120 LIBERTY STREET, NEW YORK.

The Akron

BALL BEARING

TROLLEY WHEEL



Is a demonstrated

SUCCESS

WRITE FOR FULL INFORMATION

The Akron Trolley Wheel Co.

604 E. Mill St., AKRON, OHIO

... THE ...

PROVIDENCE CAR FENDER

SAVES HUMAN LIVES.

... MANUFACTURED BY ...

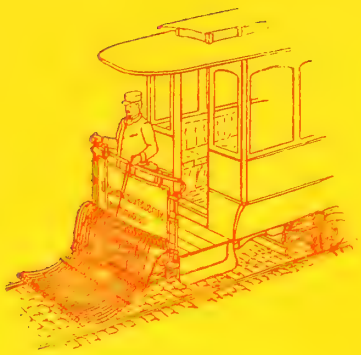
THE CONSOLIDATED CAR FENDER CO.

PROVIDENCE, R. I.

THE CONSOLIDATED CAR FENDER CO.

SOLE OWNERS AND MANUFACTURERS OF

THE GREAT LIFE SAVER



THE PROVIDENCE FENDER

WHICH IS DOING ITS GRAND WORK OF SAVING HUMAN LIVES.

ALREADY THE PROVIDENCE FENDER IS IN USE ON MORE THAN SEVEN THOUSAND CARS IN MORE THAN ONE HUNDRED CITIES AND TOWNS.

LOOK AT THIS RECORD!

97 per cent. of all persons struck by the Providence Fender have been saved.

99 per cent. of those saved were not injured.

100 per cent. of all lives placed in jeopardy have been saved when the full equipment, viz., front fender and wheel guards, has been used.

WE CAN SUBSTANTIATE THESE FIGURES

IS NOT THIS A GRAND RECORD?

HAS ANYTHING EQUAL TO IT BEEN KNOWN?

CATALOGUES AND FURTHER INFORMATION UPON APPLICATION.

THE CONSOLIDATED CAR FENDER CO.

PROVIDENCE, R. I.

PROVIDENCE CAR FENDERS

are now in practical operation on more than 7,000 cars operated on ninety-one electric roads in 175 cities and towns in the United States, South America and Europe. 95 per cent of all car fenders used in the world, other than those made by electric roads themselves, are Providence Fenders.

THE FOLLOWING IS A PARTIAL LIST OF ROADS USING THIS FENDER

Metropolitan Street Railway Co., New York City.
The Albany Railway, Albany, N. Y.
Utica Belt Line Street R. R. Co., Utica, N. Y.
Syracuse Rapid Transit Ry. Co., Syracuse, N. Y.
Syracuse & East Side Ry. Co., Syracuse, N. Y.
Syracuse, Lakeside & Baldwinsville Ry. Co., Syracuse, N. Y.
Binghamton R. R. Co., Binghamton, N. Y.
Lake Ontario & Riverside Ry. Co., Oswego, N. Y.
Troy City Ry. Co., Troy, N. Y.
Auburn City Ry. Co., Auburn, N. Y.
Middletown-Goshen Traction Co., Middletown, N. Y.
Staten Island Midland R. R. Co., Stapleton, N. Y.
Staten Island Electric R. R. Co., New Brighton, N. Y.
Van Brunt Street & Erie Basin Ry. Co., Brooklyn, N. Y.
Peekskill Traction Co., Peekskill, N. Y.
Citizens' Street Ry. Co., Fishkill-on-Hudson, N. Y.
Bennington & Hoosic Valley Ry. Co., Hoosic Falls, N. Y.
Albany & Hudson Ry. & Power Co., Hudson, N. Y.
Rochester & Suburban Railway Co., Rochester, N. Y.
Rochester & Sodus Bay Railway Co., Rochester, N. Y.
The Newburgh Electric Ry. Co., Newburgh, N. Y.
Albany & Hudson Railway & Power Co., Hudson, N. Y.
Consolidated Traction Co., Jersey City and Newark, N. J.
Plainfield Street Railway Co., Plainfield, N. J.
Passaic & Newark Electric Traction Co., Passaic, N. J.
Suburban Traction Co., Orange, N. J.
The New Jersey Electric Railway Co., Hoboken, N. J.
North Hudson County Ry. Co., Hoboken, N. J.
Paterson Railway Co., Paterson, N. J.
Elizabeth City Horse R. R. Co., Elizabethport, N. J.
North Jersey St. Ry. Co., Jersey City, N. J.
Elizabeth City R. R. Co., Elizabeth, N. J.
Atlantic Highlands, Red Bank & Long Branch Electric Railway, Red Bank, N. J.
Westfield & Elizabeth St. Ry. Co., Plainfield, N. J.
Perth Amboy Railroad Co., Perth Amboy, N. J.
Bridgeport Traction Co., Bridgeport, Conn.
Central Ry. & Electric Co., New Britain, Conn.
Waterbury Traction Co., Waterbury, Conn.
Fairhaven & Westville R. R. Co., New Haven, Conn.
Hartford & West Hartford H. R. R. Co., Hartford, Conn.
New Haven St. Ry. Co., New Haven, Conn.
New Haven & Centreville St. Ry. Co., New Haven, Conn.
Winchester Avenue St. Ry. Co., West Haven, Conn.
Hartford St. Ry. Co., Hartford, Conn.
Meriden Electric R. R. Co., Meriden, Conn.
Norwalk Tramway Co., South Norwalk, Conn.
Meriden, Southington & Compounce Tramway Co., Meriden, Conn.
Interstate Consolidated Street Ry. Co., No. Attleboro, Mass.
Fitchburg & Leominster Street Ry. Co., Fitchburg, Mass.
Fall River Street Ry. Co., Fall River, Mass.
Webster & Dudley Street Ry. Co., Webster, Mass.
Linwood Street Ry. Co., Whitinsville, Mass.
Rutland Street Ry. Co., Rutland, Vt.
Springfield Electric Ry. Co., Springfield, Vt.
City Passenger Ry. Co., Altoona, Pa.
Allentown & Lehigh Valley Traction Co., Allentown, Pa.
Altoona & Logan Valley Electric Ry. Co., Altoona, Pa.
Mountoursville Railway Co., Mountoursville, Pa.
Cleveland, Painesville & Eastern R. R. Co., Cleveland, O.
Cleveland, Berea, Elyria & Oberlin Ry. Co., Cleveland, O.
Cleveland & Chagrin Falls Electric Ry. Co., Cleveland, O.
Lorain & Cleveland Ry. Co., Cleveland, O.
Dayton & Western R. R. Co., Dayton, O.
Cincinnati & Hamilton Electric Ry. Co., Cincinnati, O.
Cleveland Electric Ry. Co., Cleveland, O.
Ohio Central Traction Co., Galion, O.
Southern Ohio Traction Co., Hamilton, O.
The Pennsylvania & Ohio Railway Co., Conneaut, O.
Dayton, Springfield & Urbana Elec. Ry. Co., Dayton, O.
Cincinnati, Lawrenceburg & Aurora St. Ry. Co., Cincinnati, Ohio.
Sandusky & Interurban Elec. Ry. Co., Sandusky, O.
Cleveland & Eastern Ry. Co., Cleveland, O.
Fort Wayne Traction Co., Fort Wayne, Ind.
Alton Railway & Illuminating Co., Alton, Ill.
St. Louis & East St. Louis Elec. Ry. Co., East St. Louis, Ill.
South Chicago City Ry. Co., South Chicago, Ill.
Cairo Electric Ry. Co., Cairo, Ill.
Indianapolis, Greenwood & Franklin R. R. Co., Greenwood, Ind.
City Electric Ry. Co., Port Huron, Mich.
Consolidated Street Ry. Co., Grand Rapids, Mich.
Jackson Street Ry. Co., Jackson, Mich.
City Street Car Co., Staunton, Va.
Richmond Traction Co., Richmond, Va.
Richmond Ry. & Electric Co., Richmond, Va.
Electric Construction Co., Richmond, Va.
Port Norfolk Electric Ry. Co., Portsmouth, Va.
Union Depot Railroad Co., St. Louis, Mo.
Citizens' Rapid Transit Ry. Co., Nashville, Tenn.
Des Moines City Ry. Co., Des Moines, Ia.
Tri-City Railway Co., Davenport, Ia.
Omaha Street Ry. Co., Omaha, Neb.
Superior Rapid Transit Co., West Superior, Wis.
Olympia Light & Power Co., Olympia, Wash.
San Diego Electric Ry. Co., San Diego, Cal.
Hull Electric Co., Hull, Quebec.
The Ottawa Street Ry. Co., Ottawa, Ontario.
Compania de Ferrocarriles del Distrito Federal, City of Mexico, Mexico.
Buenos-Aires & Belgrano Tramways Co., Buenos-Aires, Argentina.
Buenos-Aires Electric Tramway Co., Buenos-Aires, Argentina.
La Capital Tramways Co., Buenos-Aires, Argentina.
Costa Rica Electric Light & Transportation Co., San Jose, Costa Rica.
Sao Paulo Railway Light & Power Co., Sao Paulo, Brazil.
Colombo Tramway Co., Colombo, Ceylon.

No expense is spared, either in material or labor, to make the PROVIDENCE FENDER the BEST LIFE SAVING DEVICE ever attached to an electric or cable car. In fact, it is the only car fender made that, when properly used, saves 100 per cent of all lives placed in jeopardy.

MANUFACTURED BY

THE CONSOLIDATED CAR FENDER CO.

PROVIDENCE, R. I.

14 Points of Advantage Possessed by the Providence Fender

FIRST. The device is such that it **will remove the endangered person from the track** if the motorman should fail to stop the car in time.

SECOND. This removal is effected by a **projecting cradle** on which the person may fall, and which at the time of using touches the ground.

THIRD. It being impracticable to carry such a cradle touching the ground all the time, **it is possible for the motorman instantly to drop it,** while at the same time his hands are free for other purposes.

FOURTH. The mechanism is such that the motorman, after dropping his fender, **can again raise it without stopping his car** or leaving the front platform.

FIFTH. The front edge of the cradle is furnished with such rolls, and the cradle itself is of such form that it **may be dropped on any ordinary road surface without risk of breaking.**

SIXTH. **The front edge of the cradle is yielding,** so as to cushion the blow against the foot or body, if the person has fallen.

SEVENTH. The front end of the car is furnished with **a resilient shield,** covering all the rigid projecting parts of the car, such as the bumper, the draw bar and the fixtures by which the fender itself is attached to the car.

EIGHTH. The fender is strong enough and elastic enough to serve as **a substantial buffer** in colliding with other vehicles, so as, within a considerable limit, to receive all the damage itself, and prevent injury to both colliding vehicles.

NINTH. It is **detachable from the car,** so that in case of accident the conductor and motorman may readily remove it without the use of tools.

TENTH. It is **foldable against the dash,** so that if fenders are attached to both ends of the car, the rear fender, and in the car house both fenders, may be turned up.

ELEVENTH. It has a breaking part **inexpensive to repair.**

TWELFTH. It is **easily transferable** from one end of the car to the other, so that, if necessary, it may be quickly so transferred by the conductor and motorman at the end of each trip.

THIRTEENTH. It is **of simple construction and easy to repair,** and to that end all the parts are interchangeable.

FOURTEENTH. All fenders for cars of the same company are **interchangeable.**

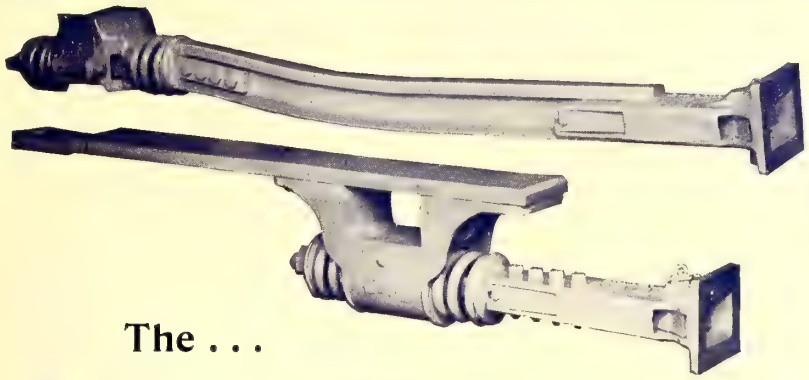
IT is not enough to say that a fender "is constructed entirely of metal." A cheap fender, constructed of gas pipe and hoop iron, could be thus described, and so deceive the reader and purchaser.

The Providence Fender *is not only "constructed entirely of metal," but is made of the* ***best quality of spring steel,*** *and the attachments are made of the* ***best malleable iron.*** *There is no gas pipe, hoop iron, rope netting, or* ***other cheap material*** *used in its construction.*

No expense is spared either in material or labor to make the ***Providence Fender*** *the* ***best life saving device*** *ever attached to an electric or cable car. In fact, it is the only car fender made that, when properly used, saves 100 per cent. of all lives placed in jeopardy.*

The following Table of Speed Run by Electric and Cable Cars may be of Interest to Railroad Men:

1 mile per hour	88 ft. per minute	1.466 ft. per second
2 " "	176 " "	2.933 " "
3 " "	264. " "	4.4 " "
4 " "	352 " "	5.866 " "
5 " "	440 " "	7.333 " "
6 " "	528 " "	8.8 " "
7 " "	616 " "	10.266 " "
8 " "	704 " "	11.733 " "
9 " "	792 " "	13.2 " "
10 miles per hour	880 ft. per minute	14.666 ft. per second
11 " "	968 " "	16.133 " "
12 " "	1056 " "	17.6 " "
13 " "	1144 " "	19.066 " "
14 " "	1232 " "	20.533 " "
15 " "	1320 " "	22. " "
20 " "	1760 " "	29.333 " "
25 " "	2200 " "	36.666 " "



ADAPTED FOR
Any Class of Car

Standard on all Elevated Railways of the United States

The . . .

Van Dorn Couplers

ARE THE . . . **ONLY AUTOMATIC COUPLERS** FOR

Elevated and Street Railways

W. T. Van Dorn Co.

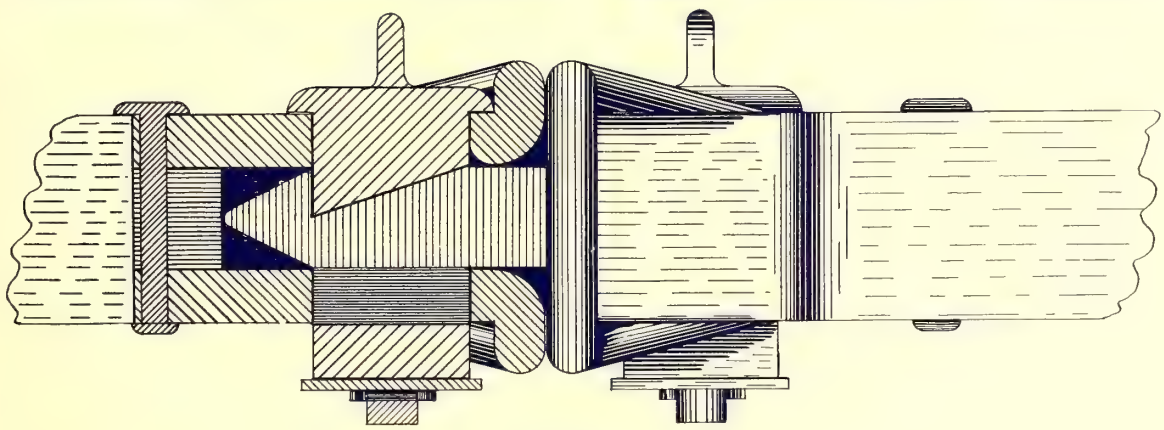
Monadnock, CHICAGO

ROBT. W. BLACKWELL,
European Representative
59 CITY ROAD, LONDON, E. C.

AUTO CAR COUPLER

FOR STREET INTERURBAN AND ELECTRIC ROADS

A TWO-PIECE AUTOMATIC COUPLER *SIMPLICITY PERSONIFIED*



PATENT PENDING

Our price will warrant its use in every service. WRITE FOR PARTICULARS

Mr. Tom I. Duffy will be in charge of our exhibit at Kansas City

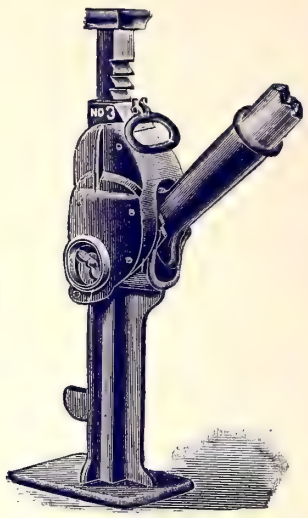
AUTO APPLIANCE CO., 1151 Marquette Building, Chicago

BARRETT

Lifting Jacks

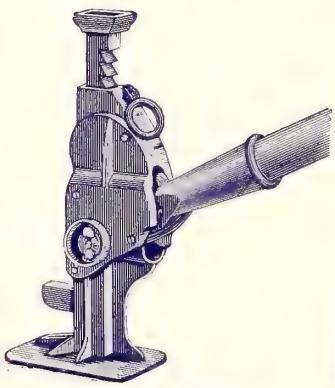
FOR ELECTRIC AND CABLE CARS

BALLAST GANG TRIP JACK
No. 6.

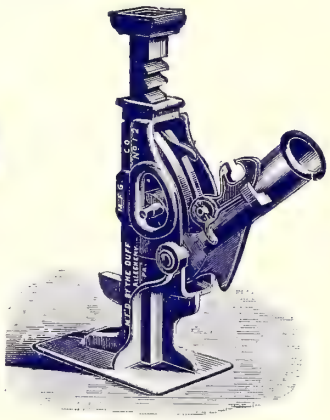


AUTOMATIC LOWERING JACK
No. 3.

The "Barrett" Jacks are undoubtedly the best, because they are powerful, light, quick and positive, and are the only jacks with an automatic lowering device, by which any load can be gradually lowered by the same movement of the lever as in raising . . . .

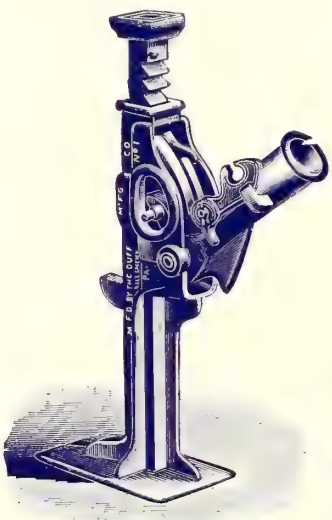


AUTOMATIC LOWERING
JACK No. 2.

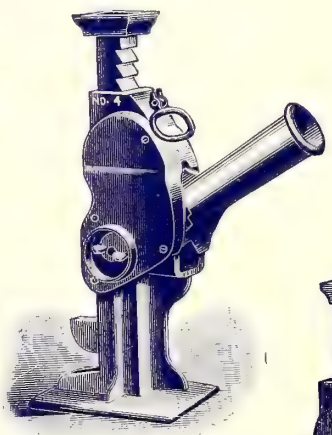


TRIP JACK No. 12.

By carrying a "Barrett" Jack in at least every other car, the jack would be instantly at hand in case of derailment. One car off the track stops all others, causing loss of traffic and inconvenience to passengers. The use of "Barrett" Jacks reduces such risks to a minimum, and in a year's traffic will save thousands of dollars . . . . . .



TRIP JACK No. 1.



AUTOMATIC LOWERING JACK
No. 4.

AUTOMATIC LOWERING JACK No. 19.

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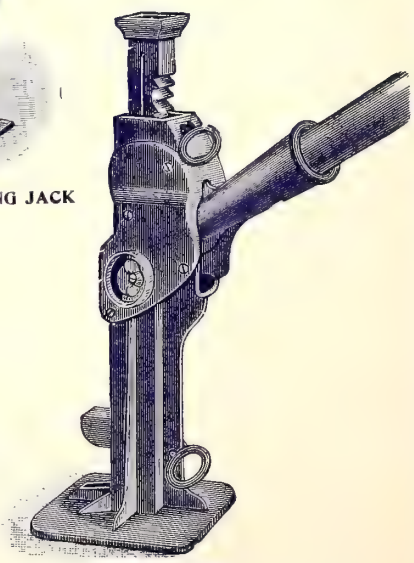
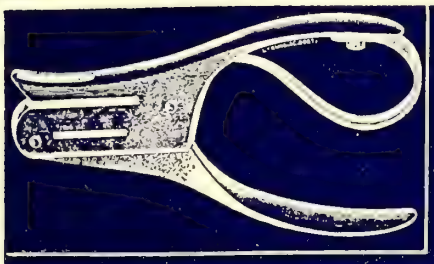
THE DUFF MFG. CO.

Allegheny, Pa., U. S. A.

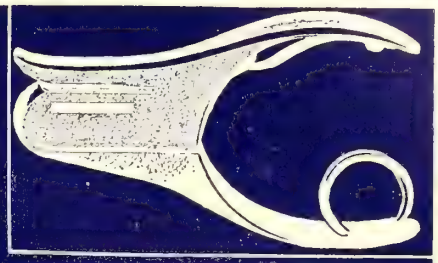


AUTOMATIC LOWERING JACK No. 5.



Uniform Buttons
Special Designs.
With Monograms on same, made to order.

Cap and Coat Badges
of every description.
In Imitation Gold, Nickel and German Silver

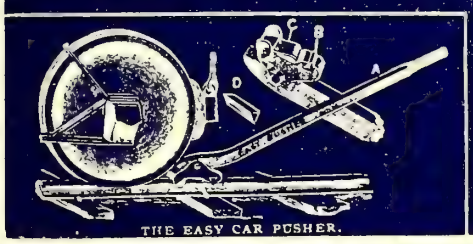


Our CAST STEEL TICKET PUNCHES are almost universally used for cancelling transfer and other tickets

CONDUCTORS WHISTLES

STARTERS WHISTLES

R. WOODMAN MFG. AND SUPPLY CO.



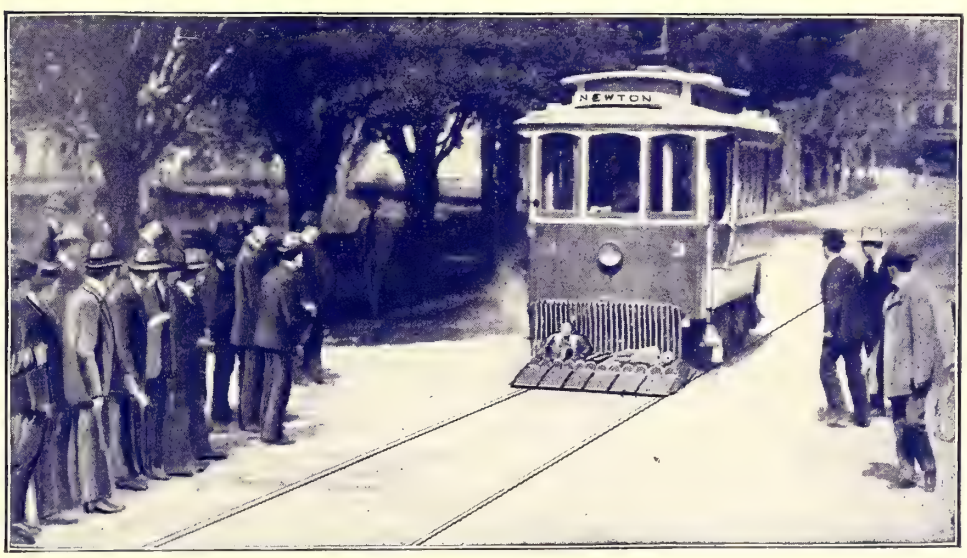
63 Oliver Street
BOSTON, MASS.

Send for Descriptive Circular and Price List of Our Railroad Supplies.

THE HIPWOOD=BARRETT FENDER

We aim to supply the very best constructed and most thoroughly perfect fender that can be built. The first cost is naturally more than for other fenders, but the repair account will quickly even up the difference

The Hipwood-Barrett Fender is sold on a very close margin, and the purchaser gets full value.



It is easily the cheapest in the long run. AS A LIFE SAVER IT NEVER FAILS.

THE HIPWOOD=BARRETT CAR AND VEHICLE FENDER CO.

EUROPEAN AGENT,
FER'D ROMÜNDER,
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97 CEDAR STREET, NEW YORK.

GREAT BRITAIN AGENT,
R. W. BLACKWELL & CO., Ltd.,
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OVERHEAD MATERIAL.

Complete Line of Material for Electric Railways.

SEND FOR CATALOGUE.

LOW PRICES. BEST MATERIAL. PROMPT DELIVERIES.

SPECIAL ATTENTION GIVEN TO EXPORT TRADE.

CABLE ADDRESS, ELMORRIS, NEW YORK. A. B. C. AND LIEBER'S CODE.

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WESTERN ELECTRIC SUPPLY CO., St. Louis.

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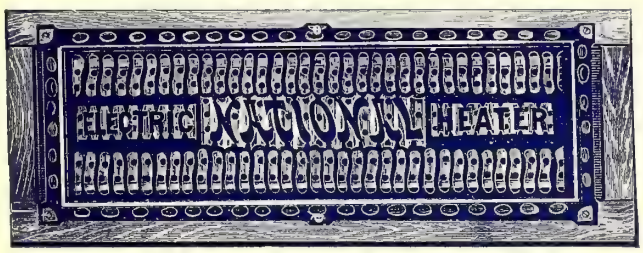
THE

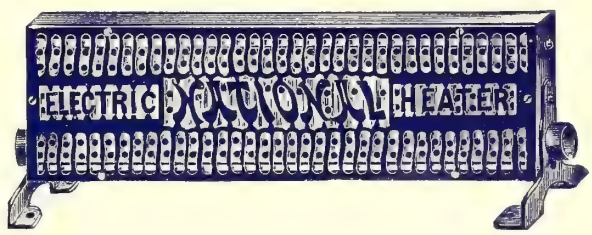
MONARCH

Fare Register

IS THE LATEST AND BEST.

Can't Be Beat





NATIONAL ELECTRIC HEATERS

are the most durable, economical and efficient. Sold under three years' guarantee

RAIL BONDS

To meet every Requirement in Railway Service.

HYDRAULIC SPLICERS

Made under LETTERS PATENT
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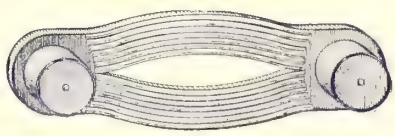

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Complete Line of Material for Electric Railways.

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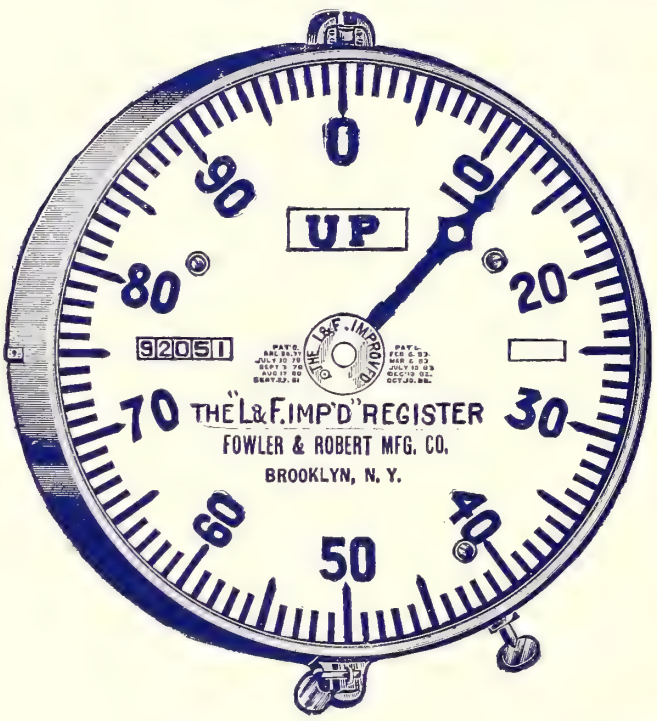
General Railway Supplies

Including the Specialties formerly made by the Lewis & Fowler Mfg. Co. and the Brooklyn & New York Railway Supply Co.

The "L. & F." Improved Fare Register

THIS REGISTER HAS STOOD THE TEST FOR TWENTY YEARS



TOTALIZES 100,000 FARES

ACCURACY AND DURABILITY

GEAR CASINGS
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CHECK PLATES, For All Style Trucks
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SPECIAL TRACK WORK
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STEEL SPRINGS FOR TRUCKS
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ARMATURE BEARINGS For Westinghouse, Gen'l Electric, Steel Motor Co.

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WESTINGHOUSE AND GENERAL ELECTRIC CANOPY SWITCHES HANDLES, FUSE BOXES BRUSH HOLDERS, ARMATURE SHAFT SLEEVES.

THISTLE BRAND METALLIC PAINTS FOR IRON AND WOOD
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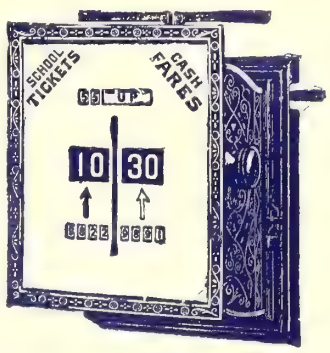
ELECTRICAL SUPPLIES

PHILADELPHIA MODEL

....THE....

"New Haven" Fare Registers



DOUBLE

SINGLE DOUBLE TRIPLE

CONTAIN ALL THE VALUABLE FEATURES OF ALL OTHER MAKES

HAVE STOOD ANOTHER TEST EQUIVALENT TO **100 Years** OF CONSTANT STREET RAILWAY SERVICE....

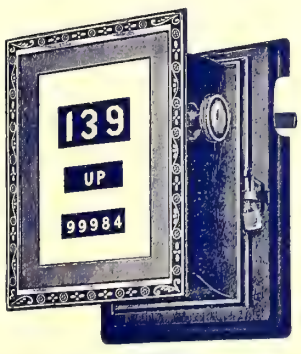
NEW ROUND SINGLE.

NEW ROUND DOUBLE.

☞ A TEST NO OTHER MAKE OF REGISTER HAS ENDURED ☜

See the Proof AT THE KANSAS CITY ....CONVENTION

OUR FULL LINE WILL BE SHOWN IN OUR SPACE NUMBER 65

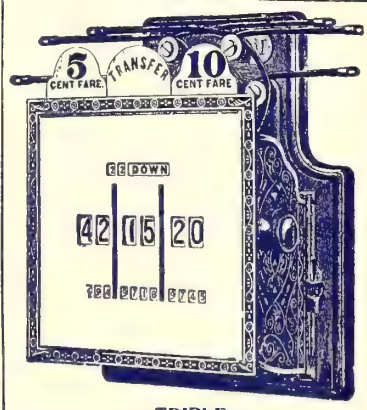


'97 MODEL

...THE...

New Haven Car Register Co.,

....NEW HAVEN, CONN.



TRIPLE

Self-Recording Register

DOUBLE REGISTER

THIS register is so named for the reason that the machine itself keeps the record of fares, relieving the operator of that responsibility, eliminating every chance of mistakes, and giving to the operator and to the railway company an absolutely correct and duplicate record of fares rung up during each trip and at the end of the day's run.

This register obviates disputes between the office and conductors. It lessens the work in the office of the railway company. It dispenses with the inspector at the end of the line, who takes the record of the ordinary register.

It acts as both a stationary and portable register, the conductor's strip being removable by him with the record of his work, while leaving an exact duplicate in the register for the company, the latter being protected under lock from interference by unauthorized persons.

SAMPLE OF WORK

FARES	TRANSFERS
2 1 2 4	7 0 9
2 1 1 4	6 8 6
2 1 0 4	6 5 8
2 0 9 0	6 2 3
2 0 8 5	6 0 3
7 1	5 7 5
	5 4 9
	4

It dispenses with the ordinary trip sheet used by conductors; in fact the conductor has only to turn in his money, name, and number of register. The report is made for him in the operation of the register.

To accomplish the above result we have spent five years' work, and instead of adding any extra work for the conductor have materially lessened it. He has simply to insert his strip and turn the set handle at the beginning and end of his run. The record is made, and the difference between the record at starting and stopping shows the fares rung up.

The working parts of the register are made of the best cold rolled steel, bright and rust proof. Every part is numbered and positively interchangeable.

In producing this register we have kept in view the cardinal and essential points of simplicity, durability, accuracy and reliability.

SINGLE REGISTER

St. Louis Register Co.

605 Security Building, St. Louis, U. S. A.

An Honest Register.

Diogenes, the philosopher, went a hunting for an honest man with a searchlight.

Many street railway companies are hunting for an honest fare register.

Diogenes did not find this honest man, but you can find that fare register if you will just turn your searchlight in this direction.

The International Register is a register which can neither be intimidated nor corrupted. It is the only register which cannot be opened without detection, and which cannot be set back at all.

It has a signature seal which always shows if it has been opened.

It has a totalizer which no amount of ingenuity can set back, change or alter in any way.

It is a strong, durable, carefully-made register which works with perfect accuracy and which will keep watch of both the cash fares and transfers with relentless persistency.

This is the register you need on your line.

It is made both in single and double registers —for cash alone, or for cash and transfers.

Just send for a list of the roads using it. This in itself is a good advertisement.

The International Register Co.,

133-139 South Clinton Street,

CHICAGO, ILL.

SALES AGENTS:

FRANK RIDLON COMPANY,
200 Summer St., Boston, Mass.

THE MAYER & ENGLUND COMPANY,
10 South Tenth St., Philadelphia, Pa

JOSHUA HENDY MACHINE WORKS,
38 Fremont St., San Francisco, Cal.

RAILWAY REGISTER MFG. CO.

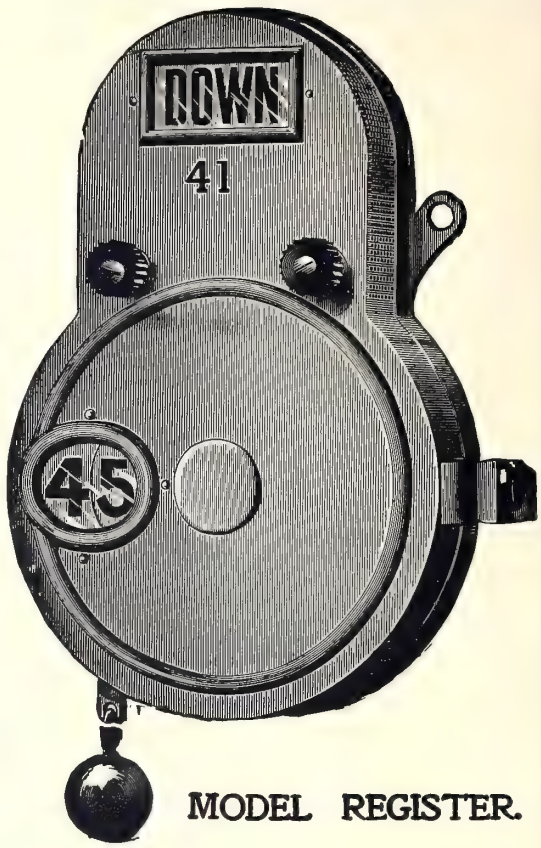
MANUFACTURERS OF ALL STYLES OF ...

PORTABLE and STATIONARY

REGISTERS

.. ALSO FULL LINE OF ..

Brass Fixtures, Leather Goods, Etc., Etc.

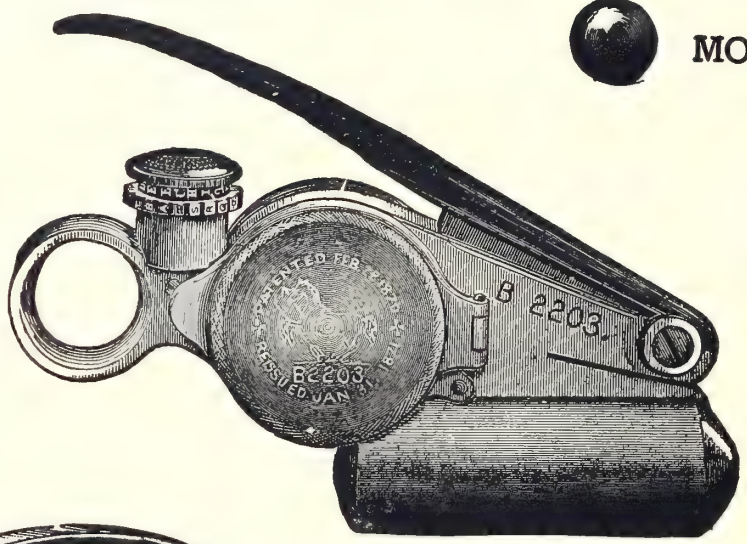


MODEL REGISTER.

ALARM REGISTERING PUNCH

Especially adapted for any number of cash fares, tickets and transfers.

Adopted by the Melbourne Tramway & Omnibus Co., of Melbourne, Australia, for their entire system.



Thousands of these registers in use in this country and Canada, and have stood the test for years.

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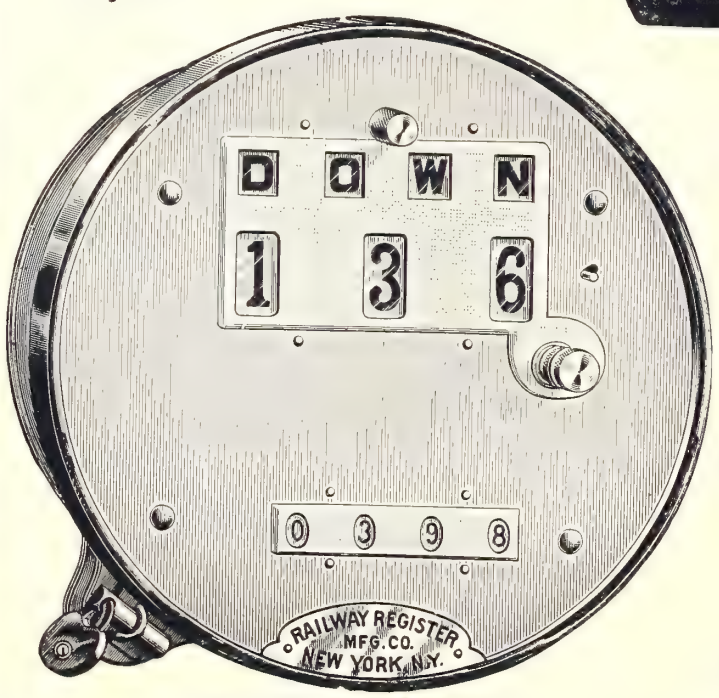

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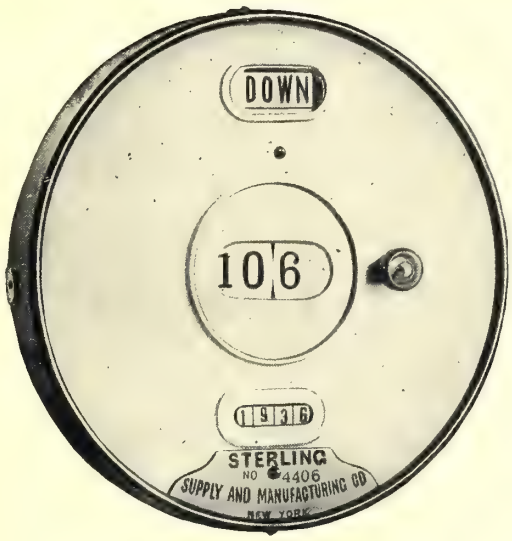
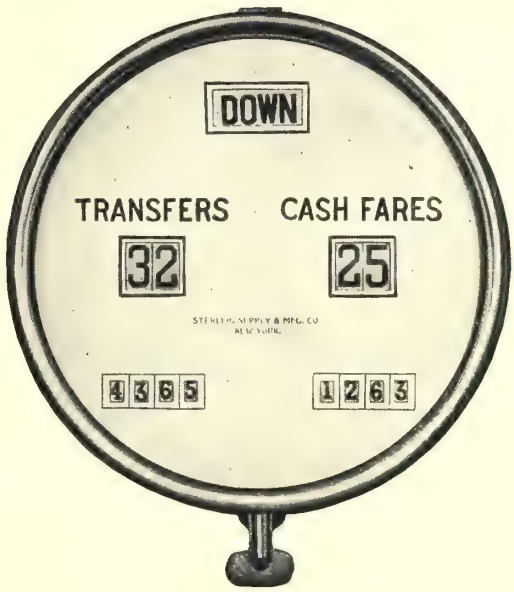


Sterling No. 1—("The Broadway")



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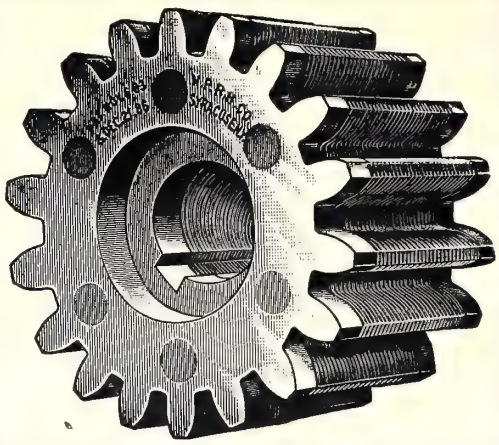

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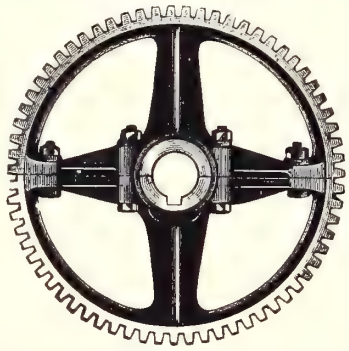

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MANUFACTURERS OF HIGH GRADE RAWHIDE FOR NOISELESS GEARS

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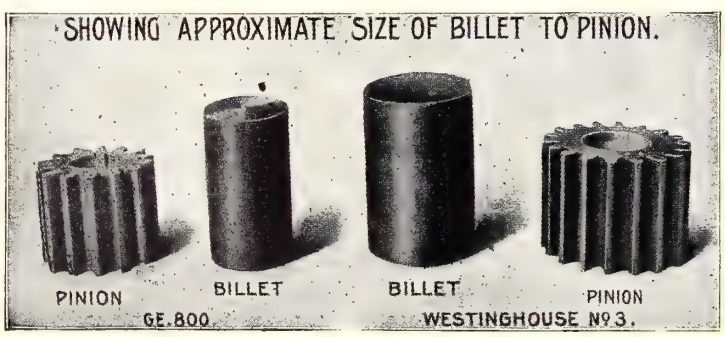

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We make them for
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ALSO Patent Pressed Steel Motor Pinions OF SPECIAL HIGH CARBON STEEL
LONGEST IN LIFE

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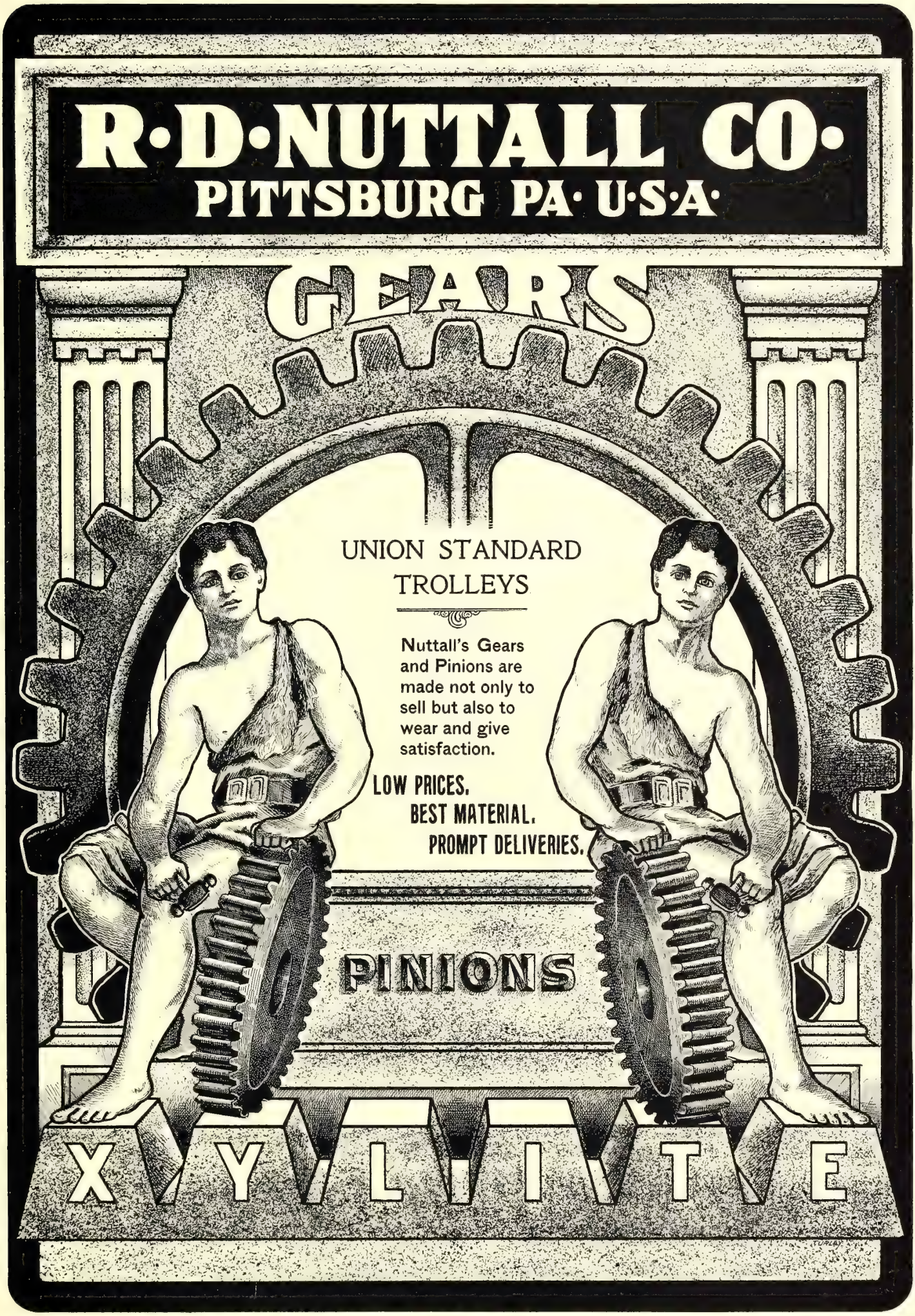
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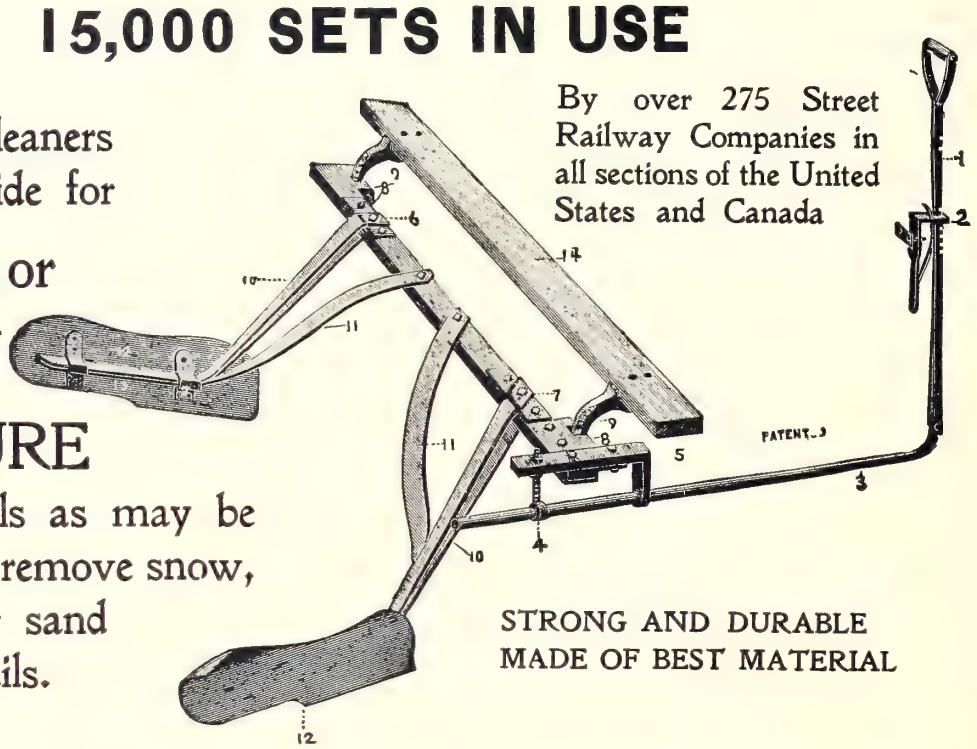

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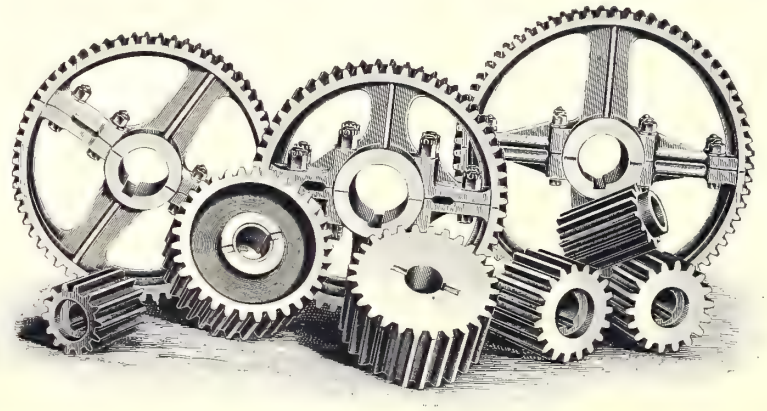
FOR ALL TYPES OF MOTORS



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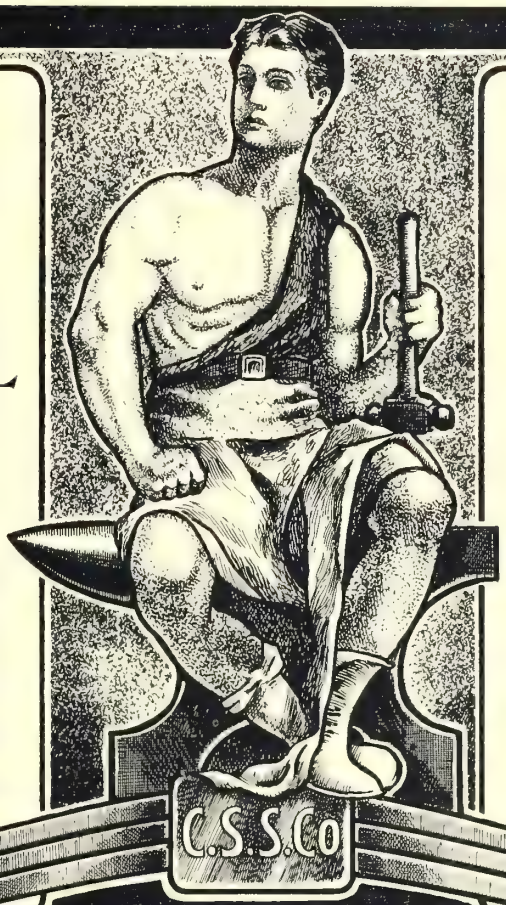
QUALITY, STRENGTH AND MECHANICAL SKILL

Have always been strong features in the manufacture of our SPRINGS, and the prime factors in placing them high in the estimation of all users.



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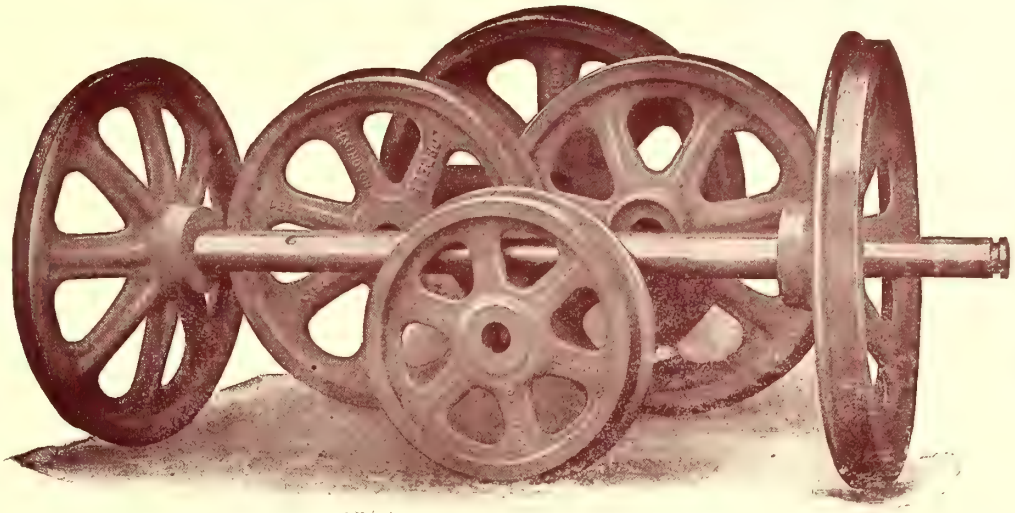

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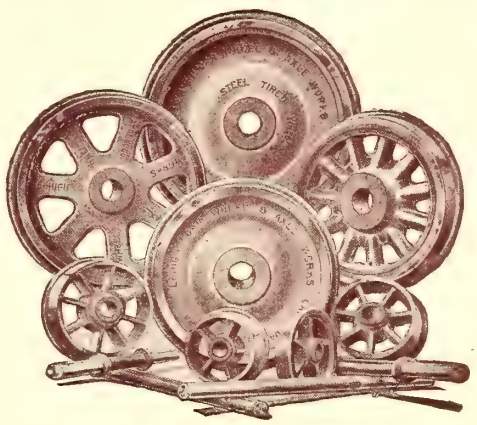

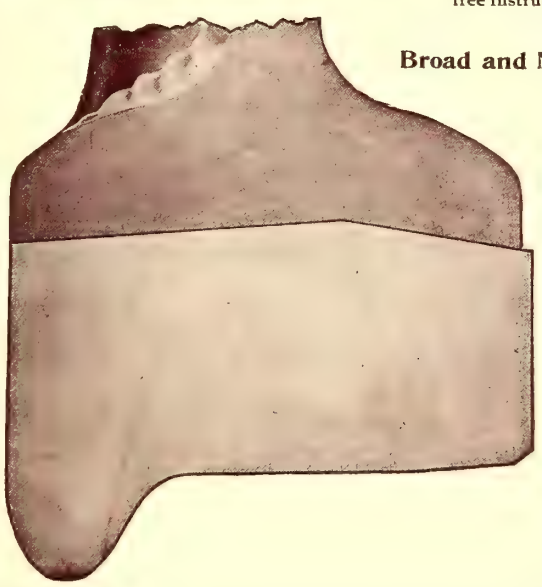

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Wheels fitted to Axles and prices furnished on application . . . .

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Heavy Chill
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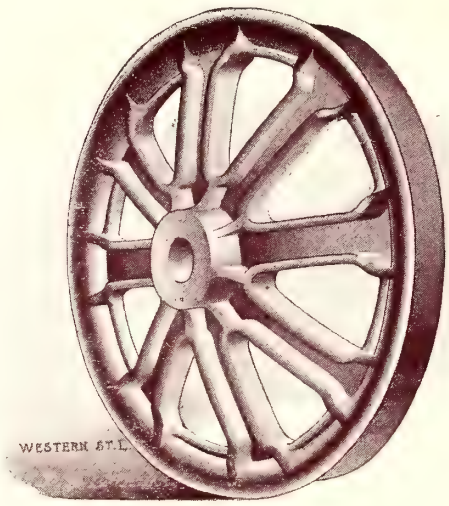

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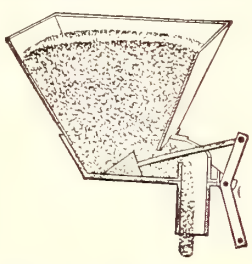

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FEW PARTS PRICE LOW

ENDORSED BY LEADING ROADS IN AMERICA AND EUROPE.

Sample Pair sent for trial to any road

Cannot Rust, Leak, Waste Sand, Draw Moisture

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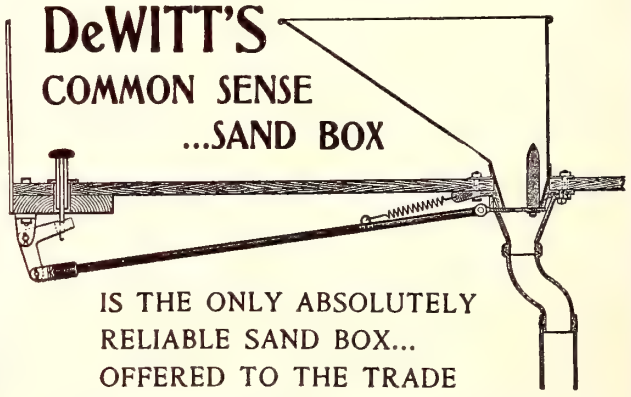
THE CONSTANT DISCARDING OF OTHER MAKES OF SAND BOXES, AND THE SATISFACTORY EXPERIENCE OF THOSE USING OUR DEVICE, ADD CONVINCING TESTIMONY TO OUR CLAIM THAT...

DeWITT'S COMMON SENSE ...SAND BOX



IS THE ONLY ABSOLUTELY RELIABLE SAND BOX... OFFERED TO THE TRADE

There is no other box on the market that can show a six years' record without repairs on box proper, or refusal to work. In use all over the world. Made to outlast the car body to which it is attached. Delivers the sand instantaneously and as much of it as desired. No guess work about it.

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TOO MUCH SAND
is often as bad as too little.
The Kilbourn Track Sanding Device is just right. It doesn't waste sand, but it deposits enough in the right place to give satisfaction. You can use any kind of sand, wet or dry, fine or coarse, which means a practical, tangible and economical saving on your line.
Why don't you investigate it?
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THE "BEVERLY" RATCHET CLUTCH BRAKE HANDLE

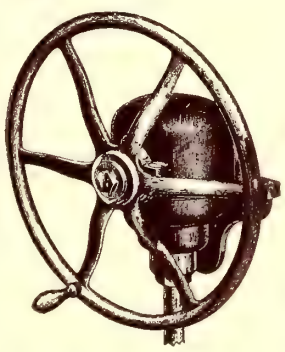
is simple, strong and reliable and is designed

FOR USE ON STREET CARS

THE handle is made of the very best composition, the clutches are steel and machine cut, the workmanship and finish is of the best. It has been adopted by some of the largest Street Railways and Car Manufacturers as Standard, and gives perfect satisfaction in every instance.

The "Beverly" Ratchet Clutch Vertical Brake Wheel

Is designed for use on Vestibuled Street Cars



It is very simple and powerful, giving a leverage equal to a 15-inch handle Like the "Beverly" Brake Handle, it is made of the best material throughout. The clutches are of steel and machine cut, and the workmanship and finish are the best obtainable. It takes up but 10 inches of space on the car platform It has been adopted generally for use on Vestibule cars, and gives the best of satisfaction.

Car builders using "Beverly" Brake Handles and "Beverly" Brake Wheels:

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BEVERLY ENGINE & MACHINE CO., Beverly, Mass., U. S. A.

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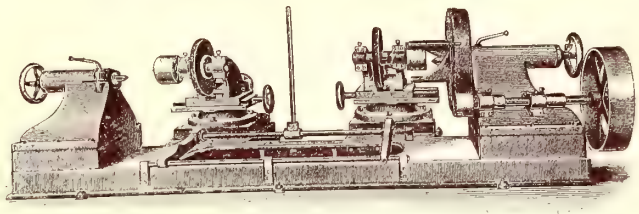
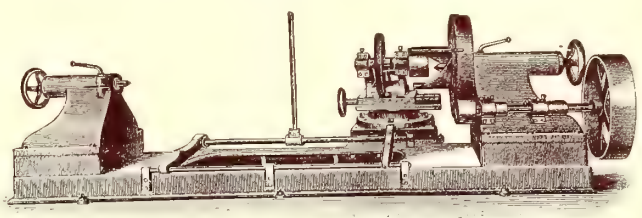
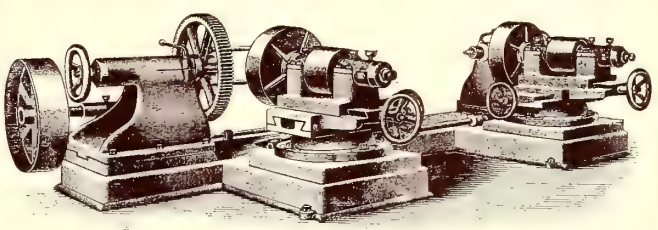
Car Wheel Grinders



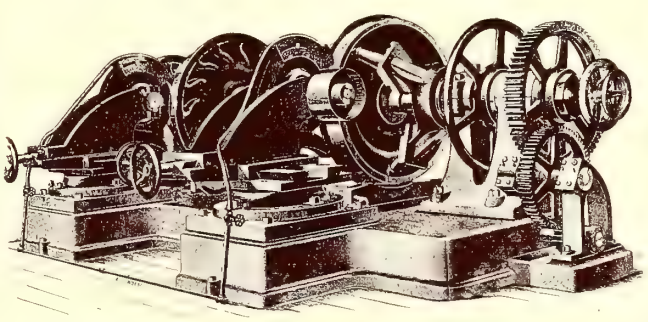
No. 1 Grinder is equipped with 18x1½ in. emery wheels. The head and tail stocks and emery wheel heads are on one solid base, which prevents vibration and secures accurate work. The emery wheel head is practically upon a compound slide rest, which is on a swivel head admitting of any desired angle. They are so arranged that one operator can grind two wheels at a time.



No. 2 machine is designed for places where but a comparatively small number of wheels are to be ground. It is practically the same as No. 1, with the exception that it has but one grinding attachment, and by the use of a swing, which is quickly and easily improvised, and the use of a lever for centering the wheels, they are quickly turned from end to end



No. 3 machine has been designed to grind wheels either on or off from axles and is arranged to grind two wheels at one time. We claim for this machine that, by having tail stock and wheel heads fastened to one bed, wheels may be ground perfectly round, and when so ground will give a greater mileage and not become skidded nearly as quickly as when ground on their own bearings.



No. 4 Grinder is designed for use of water in grinding emery wheels 18x1½ ins

Detailed information and complete catalogue of special grinding machinery and emery wheels mailed on request.

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Section VIII.

Rolling Stock

STREET RAILWAY JOURNAL
October, Nineteen Hundred

FOR ALPHABETICAL INDEX TO ADVERTISERS, SEE PAGES 5, 6, 7

Jackson & Sharp Company

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ONE OF OUR LATEST CROSS SEAT CARS WITH SMOKING ROOM

Details of Finish and Equipment made to suit Purchaser

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Facilities Unexcelled

Competent Staff

Large Stock of Seasoned Lumber

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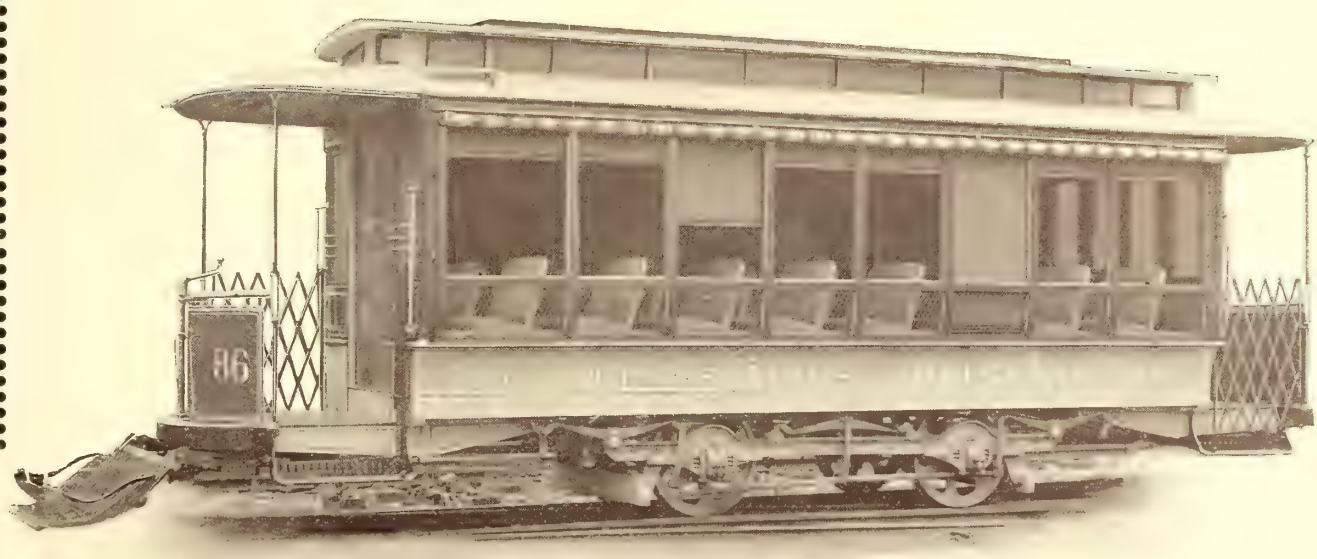
WILMINGTON, DELAWARE

Cross-Seat Cars are the most Popular for Summer as well as Winter Service



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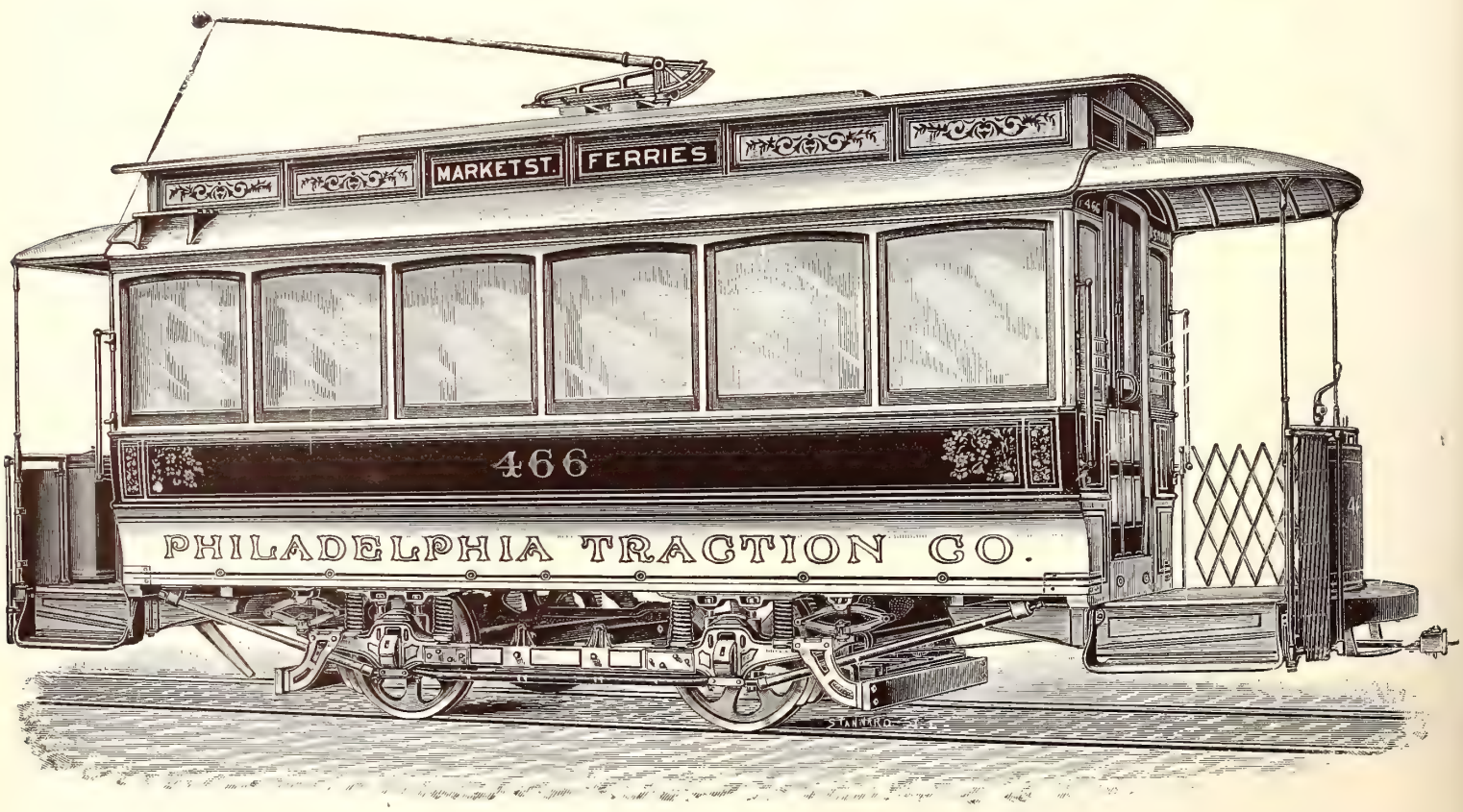
AND TRUCKS

INTERIOR OF PHILADELPHIA "MARKET STREET" CAR.



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Are equipped throughout with the finest machinery and appliances, and our manufacturing and shipping facilities are unexcelled.

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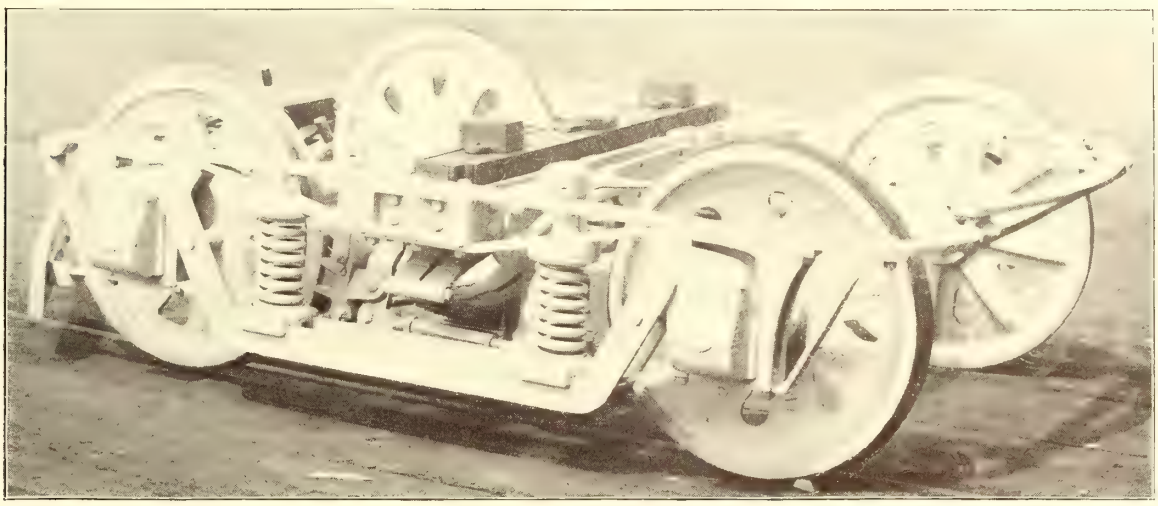
Their Product

Is strictly modern in every respect, possessing in the highest possible degree the essential features of beauty, durability and economy. It includes

CARS AND TRUCKS FOR ALL KINDS OF MOTIVE POWER.



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Standard Closed Car of the Milwaukee Electric Railway and Light Company. Car Body, 29 feet long.

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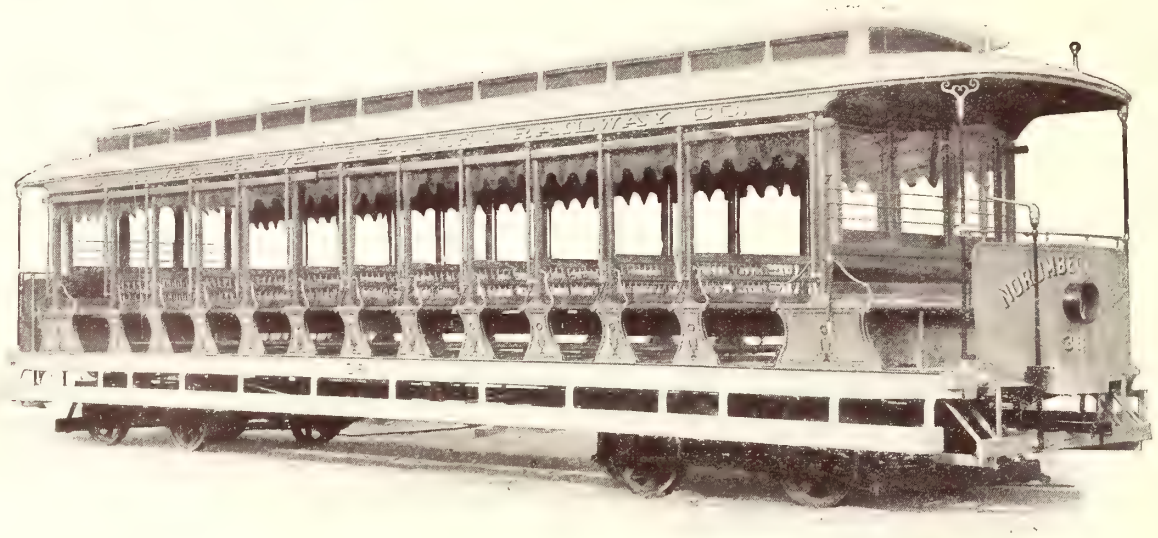
ESTABLISHED 1839

J. M. JONES' SONS



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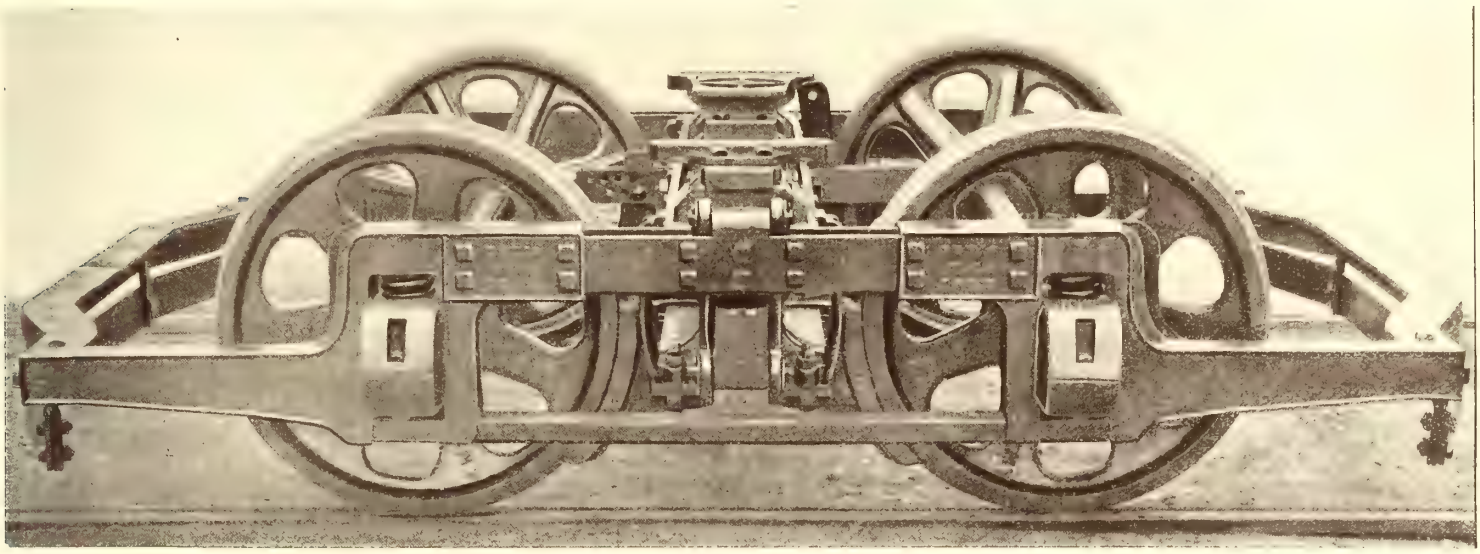
TRUCKS

For all kinds of Service

ARE NOTED FOR

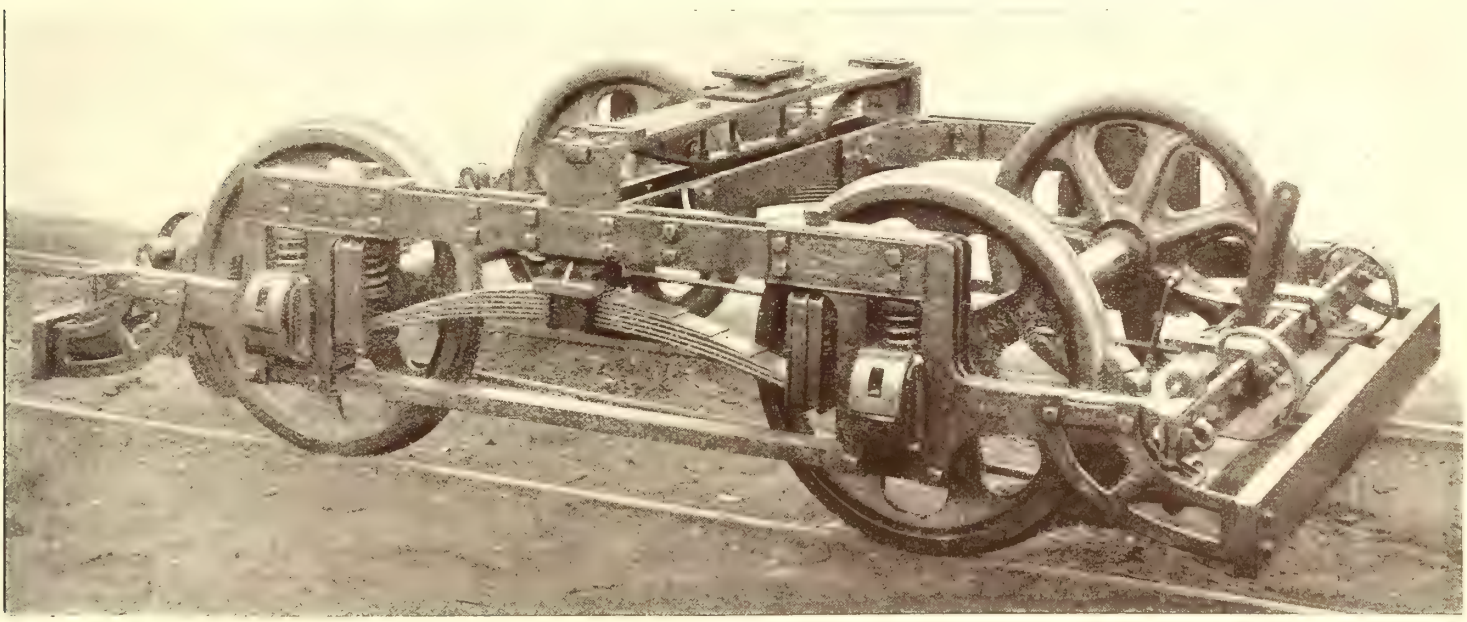
SIMPLICITY, STRENGTH, EASY MOTION, POWERFUL BRAKES, and LOW COST OF MAINTENANCE



No. 44 Truck for Open or Box Cars.

4′ and 4′ 6″ WHEEL BASE.

Designed to meet special requirements of Long Open Cars where low steps are required. Carries car no higher than single truck. Short Wheel Base. Easy Riding. Takes Curves Smoothly. Swing Motion. Quick Acting, Powerful Brake.



No. 40 Truck for Open or Box Cars.

4′, 4′ 6″ and 5′ 0″ WHEEL BASE.

The BEMIS CAR BOX CO.

MANUFACTURERS
BEMIS DUST PROOF, SELF-OILING JOURNAL BOXES

Springfield, Mass.

BOSTON OFFICE:
317 EXCHANGE BUILDING.
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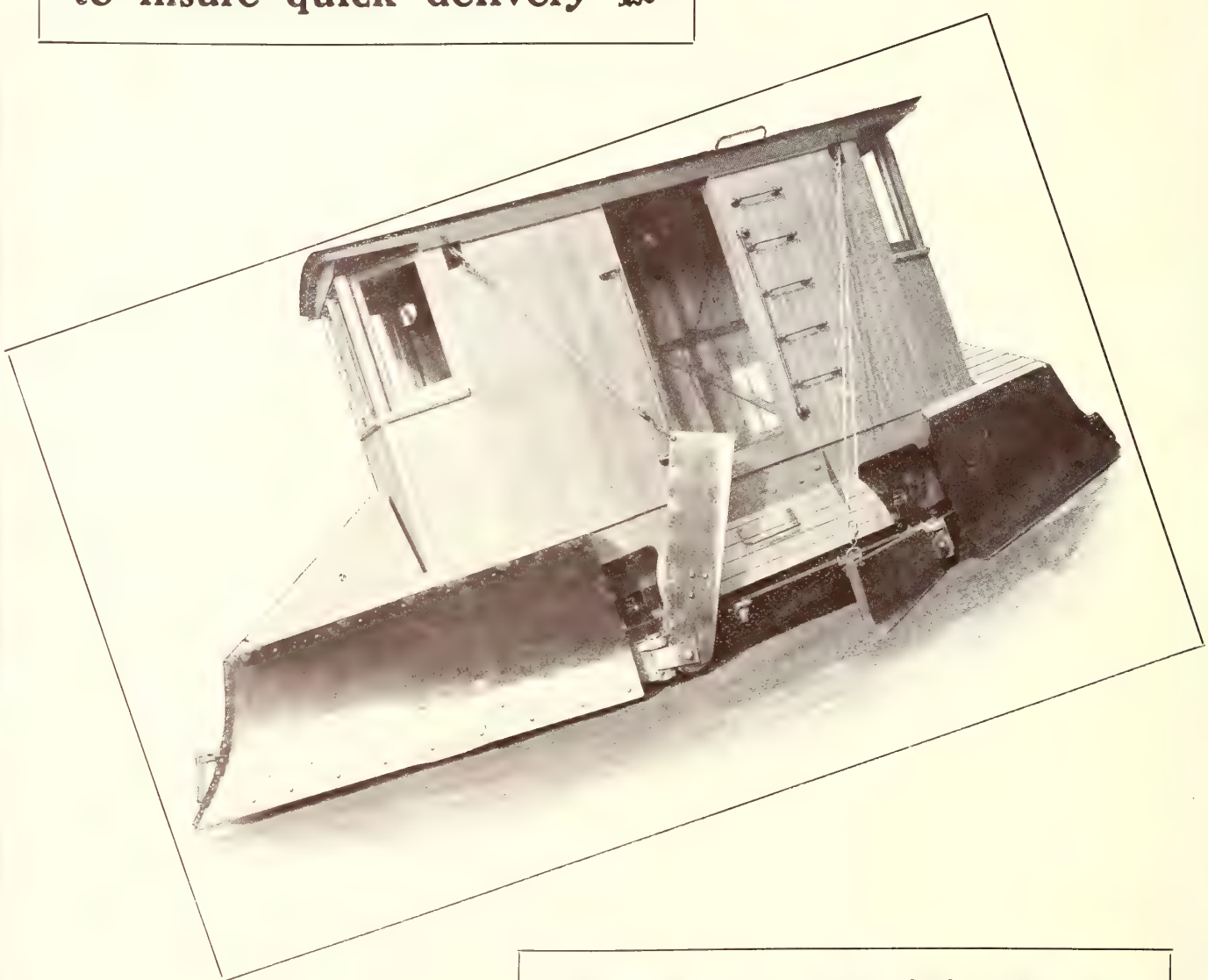
97 QUEEN VICTORIA STREET.
F. NELL, Agent.

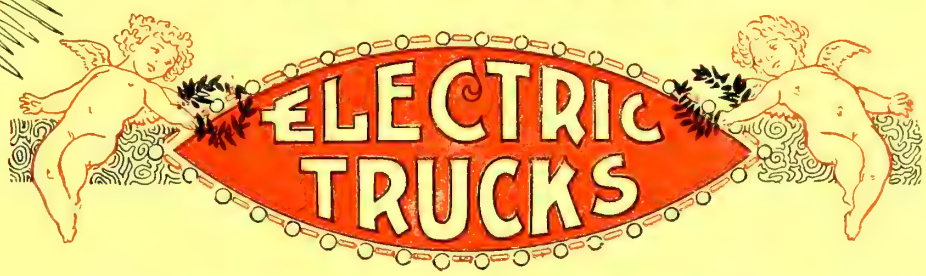
Wendell & MacDuffie
26 Cortlandt St. New York are now ready to receive your orders for Snow Plows and Sweepers Order now to insure quick delivery



TAUNTON
LOCO. MFG. CO.
Taunton, Mass., U. S. A.
Manufacturers
WENDELL & MACDUFFIE
26 Cortlandt St. New York
Selling Agents

PECKHAM'S

SYSTEM
—OF
SINGLE & DOUBLE



As exhibited at the Annual Street Car Convention held at Kansas City, Mo., Oct. 16-17-18-19, 1900.

The largest and most complete System of Electric Trucks in the World.

Adapted to any and all Conditions of Electric Service.

Adopted as Standard by the largest Electric Railways in the United States and Europe.

OVER 15,000 IN USE IN THE UNITED STATES OF AMERICA

SATISFACTION GUARANTEED

For Descriptive Catalogue, Testimonials, Price Lists and Blue Prints, apply to

THE PECKHAM TRUCK COMPANY,

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PARIS OFFICE, Bureau De Paris,
50 Boulevard Haussman.

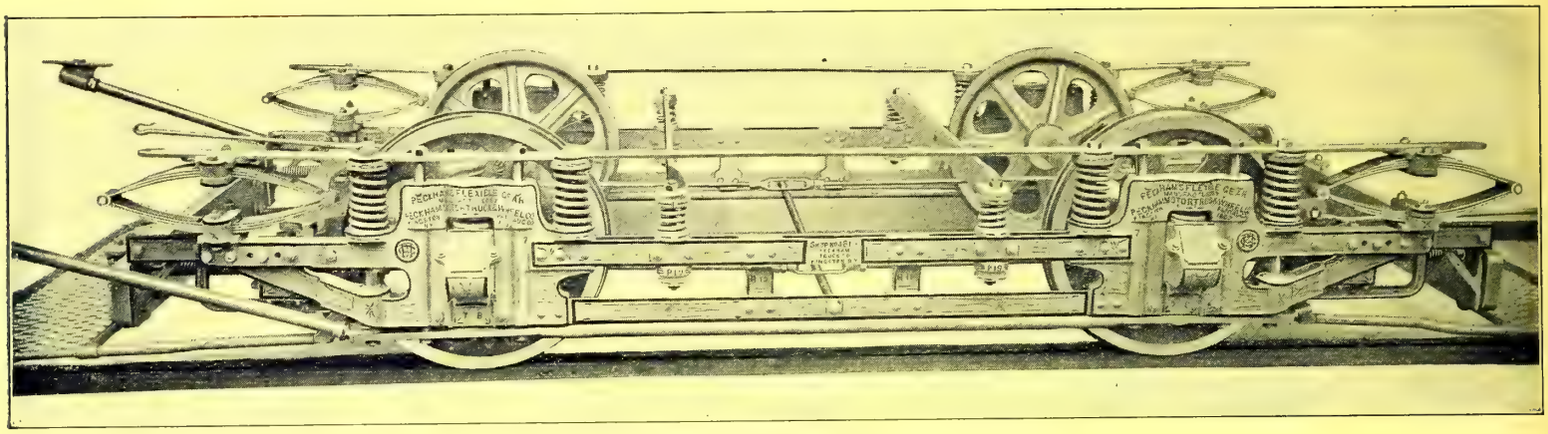
PECKHAM'S "EXCELSIOR" "SINGLE" TRUCKS

Cantilever
...Extension

EXCELSIOR No. 7 B

DIMENSIONS: { Length, Wheel Base, 6 to 8 feet, as ordered.
" Spring Base (7-ft. Wheel Base), 13 feet.
" Open Car Truss, to suit length of Car Body.

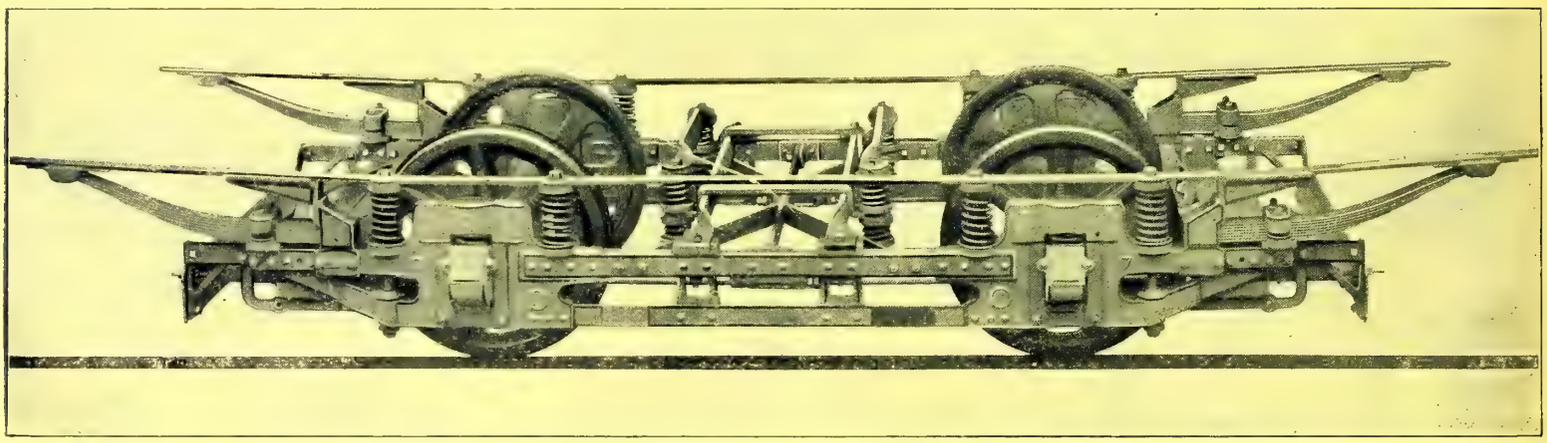
Designed for Short and Medium Length Closed and Open Electric Cars.



EXCELSIOR No. 7 D

DIMENSIONS: { Length, Wheel Base, 6 to 8 feet, as ordered.
" Spring Base (7-ft. Wheel Base), 16 feet.
" Open Car Truss, to suit length of Car Body.

Designed for Medium and Extra Long Closed and Open Electric Cars.

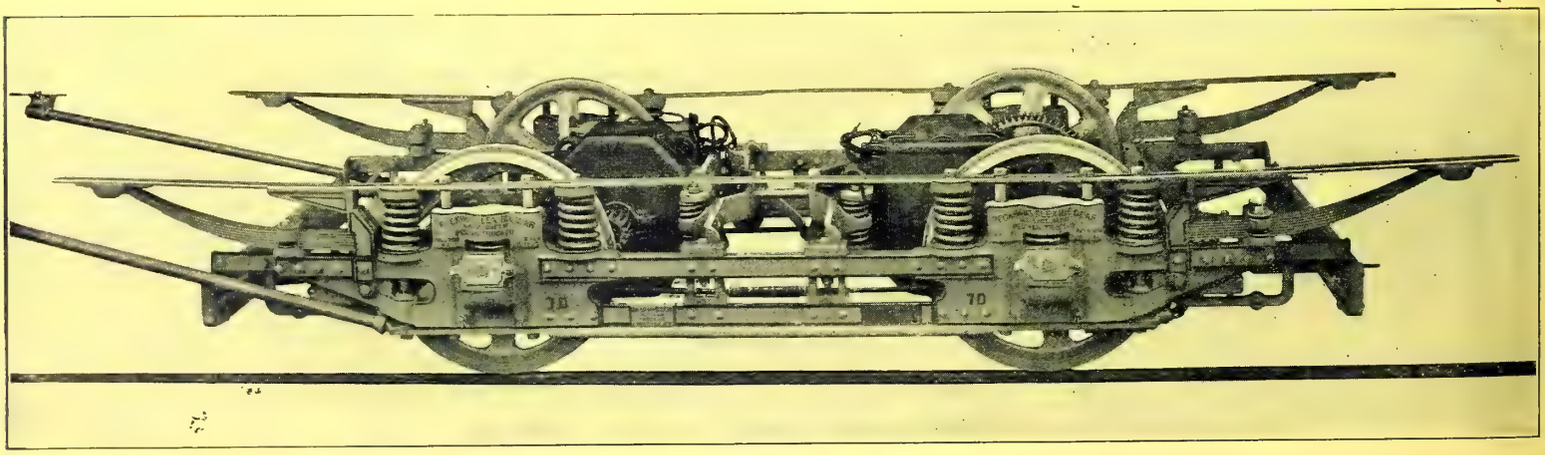


EXTRA STRONG EXCELSIOR

Designed for Extra Heavy Cars and Severe Service.

"Cincinnati Special"

DIMENSIONS: { Length, Wheel Base, 6 to 8 feet, as ordered.
" Spring Base, (7-ft. Wheel Base), 16 feet.
" Open Car Truss, to suit length of Car Body.



This Truck was Designed Expressly for the Cincinnati Street Railway Company, Cincinnati, Ohio, who have adopted it as their Standard and have over 400 in use.

PECKHAM'S Counter-Balanced Cantilever Extension

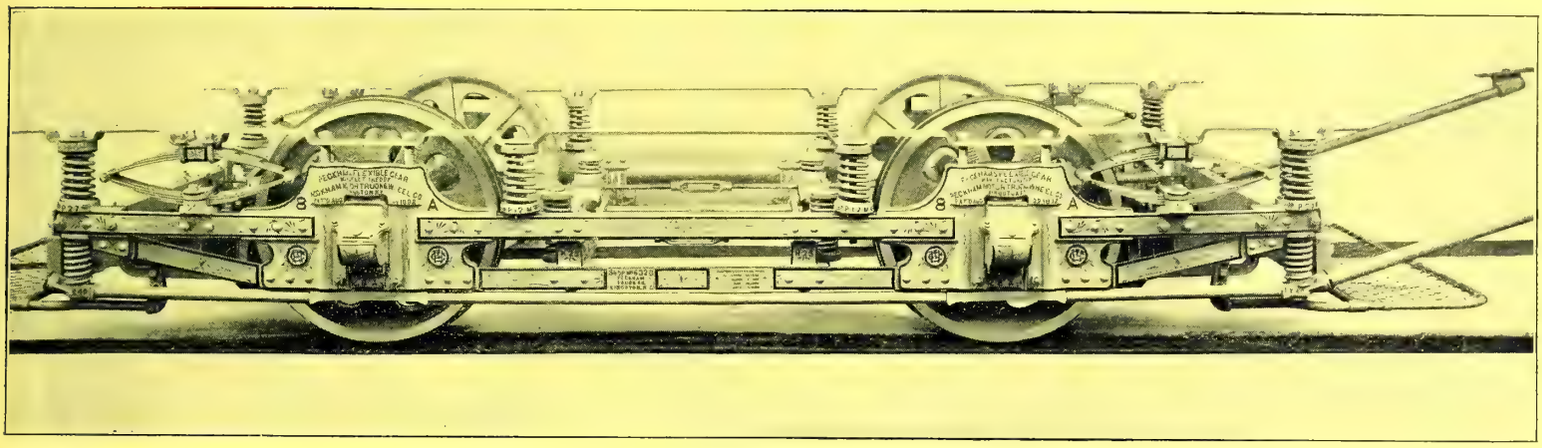
"High Speed" Single Trucks

Especially Adapted for High Speed and Double Decked Cars. Strictly Non-Oscillating. All Parts Machine Fitted

STANDARD

DIMENSIONS: Length, Wheel Base, 6 to 8 feet, as ordered.
" Spring Base (7-ft. Wheel Base), 13 feet 4 inches.
" Open Car Truss, to suit length of Car Body

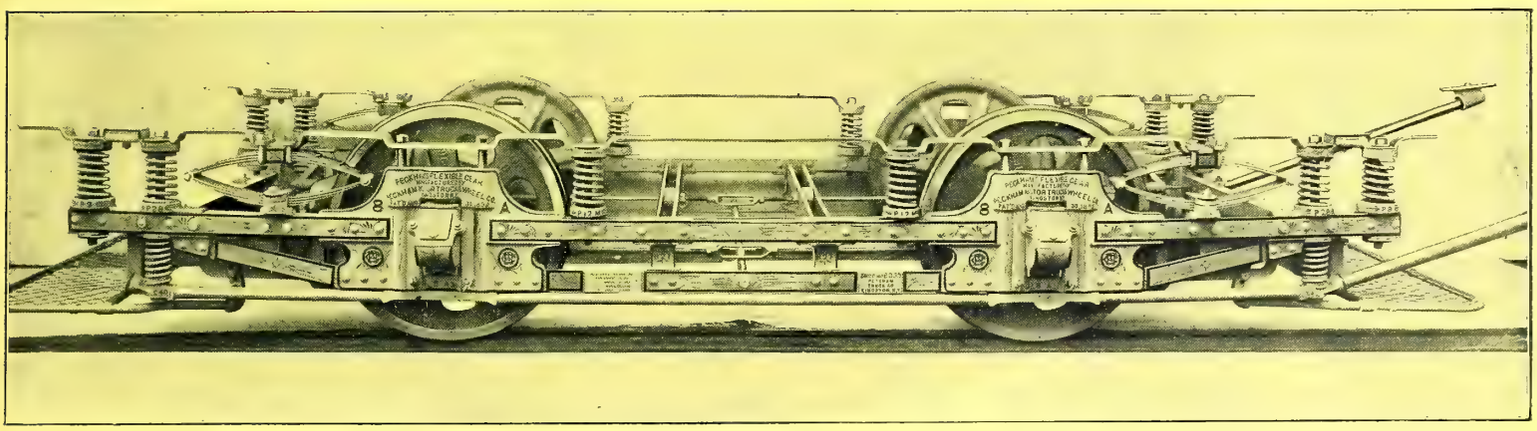
Designed for 18 to 20 Feet Closed and 28 to 30 Feet Open Cars.



EXTRA LONG

DIMENSIONS: Length, Wheel Base, 6 to 8 feet, as ordered.
" Spring Base (7-ft. Wheel Base), 14 feet 6 inches.
" Open Car Truss, to suit length of Car Body.

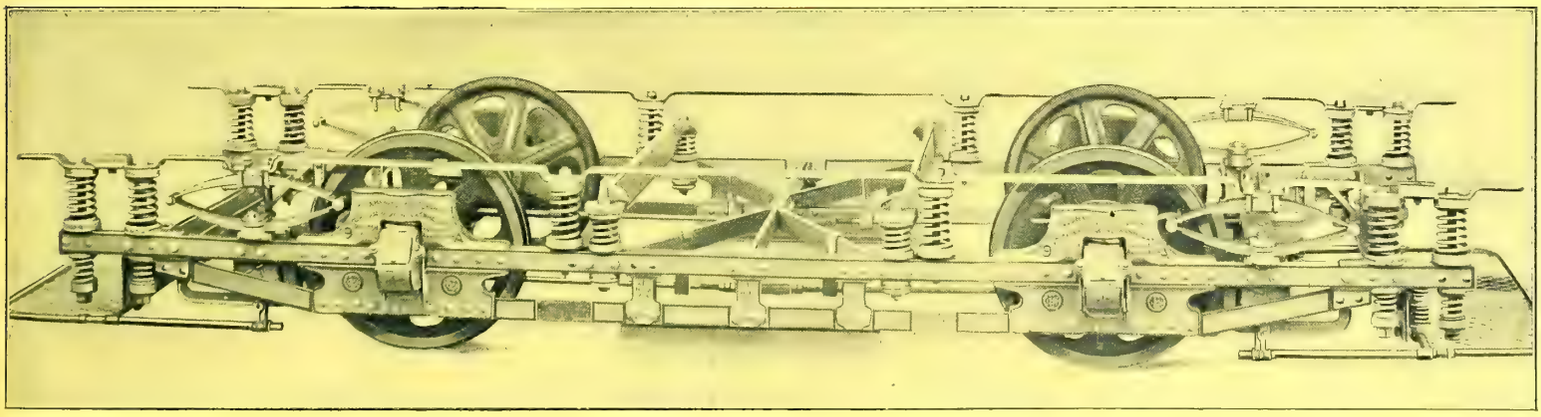
Designed for 20 to 22 Feet Closed and 28 to 32 Feet Open Cars.



EXTRA STRONG, "EXTRA LONG" "Metropolitan Special"

Designed for Extra Heavy
20 to 24 Ft. Closed and 30 to 35 Ft. Open Cars.

DIMENSIONS: Length, Wheel Base, 6 to 8 feet, as ordered.
" Spring Base (7-ft. Wheel Base), 14 feet 6 inches.
" Open Car Truss, to suit length of Car Body.

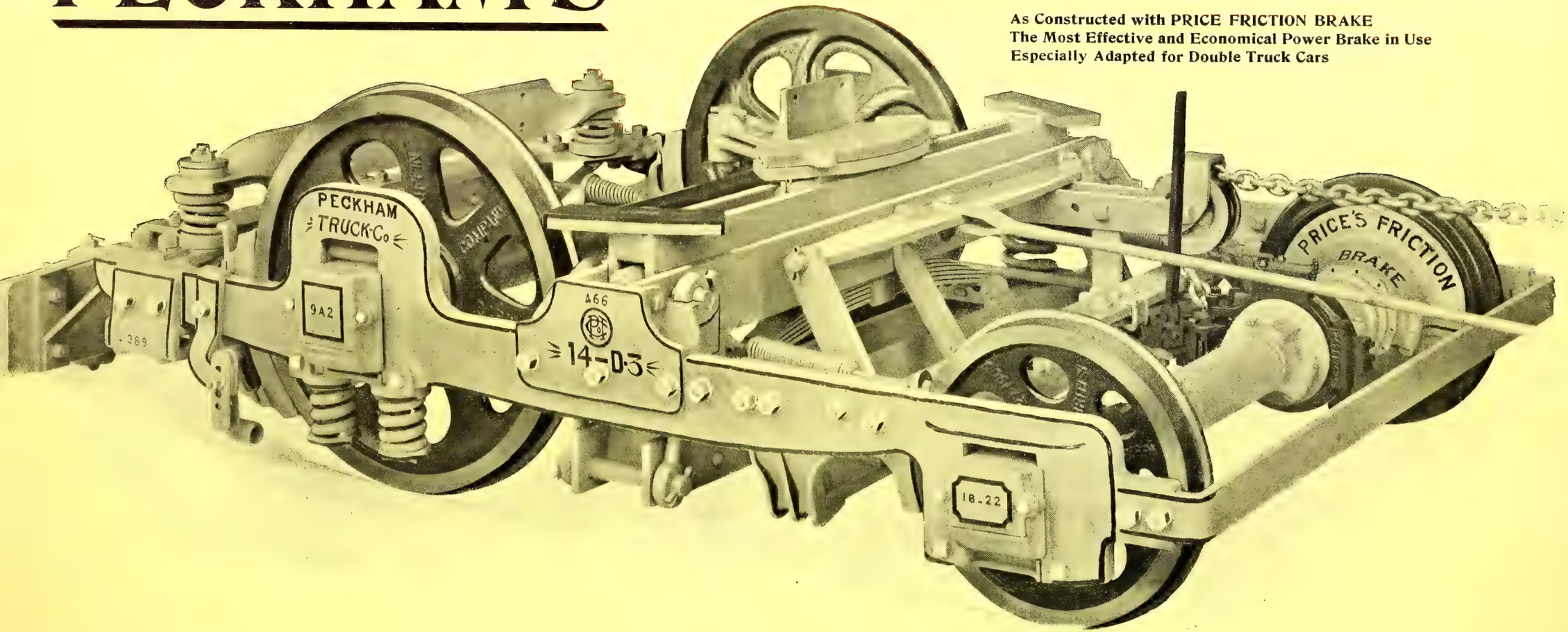


This Truck was designed Expressly for the Extra Long (22 Ft. Closed—32 Ft. over all) Electric Conduit Cars of the Metropolitan Street Railway Co. of New York, where 100 are in use Making at Times a Speed of Twenty Miles an Hour without Oscillation.

PECKHAM'S

Centre Bearing Swing Bolster "MAXIMUM TRACTION" TRUCK TRADE MARK 14 D=3

As Constructed with PRICE FRICTION BRAKE
The Most Effective and Economical Power Brake in Use
Especially Adapted for Double Truck Cars



THE ONLY CENTRE BEARING "SWING BOLSTER" MAXIMUM TRACTION TRUCK

Guaranteed to meet Any and All Conditions of Electric Railway Service where Only One Motor Per Truck is Required
Traction Can be Varied to meet Any and All Conditions of Service

Jumping the Track, so common with Side-Bearing Maximum Traction Trucks, is Absolutely Prevented with this form of Construction

DIMENSIONS:

Wheel Base,	4 feet 6 inches
Diameter of Wheels,	30 to 33 inch Driving 20 to 22 inch Pilot
Diameter of Axles,	3¾ or 4 inch on Driver
" "	3¼ or 3½ inch on Idle Wheel
Weight, without Motors,	4500 pounds

MANUFACTURED BY

The Peckham Truck Company

GENERAL SALES OFFICE:
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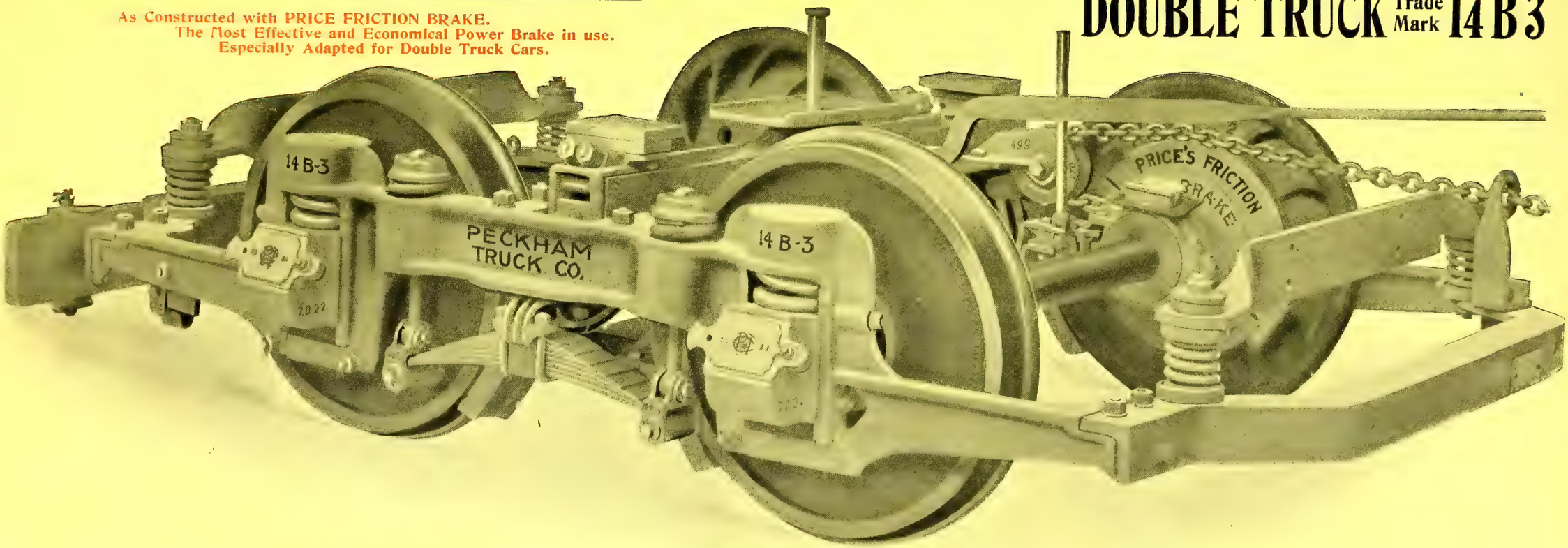
PECKHAM'S "EXTRA STRONG" ALL STEEL SHORT WHEEL BASE

DOUBLE TRUCK Trade Mark 14 B 3

As Constructed with PRICE FRICTION BRAKE.
The Most Effective and Economical Power Brake in use.
Especially Adapted for Double Truck Cars.



EQUIPPED WITH CENTRE BEARING SWING BOLSTER AND INSIDE BRAKES.

GUARANTEED to be the strongest, easiest riding and best Braking Electric Truck in use. Pedestals, Journal Boxes and End Supports accurately machine fitted. Weight of one truck, without motor, 5,500 pounds.

ADOPTED AS STANDARD BY THE LARGEST ELECTRIC RAILWAYS IN THE UNITED STATES

Some of the Largest Electric Railways that have adopted this Truck as Standard:

METROPOLITAN STREET RAILWAY COMPANY, Kansas City, Mo.
CLEVELAND CITY RAILWAY COMPANY, Cleveland, O.
WASHINGTON TRACTION & ELECTRIC CO., Washington, D. C.
NORTH JERSEY STREET RAILWAY CO., Jersey City, N. J.
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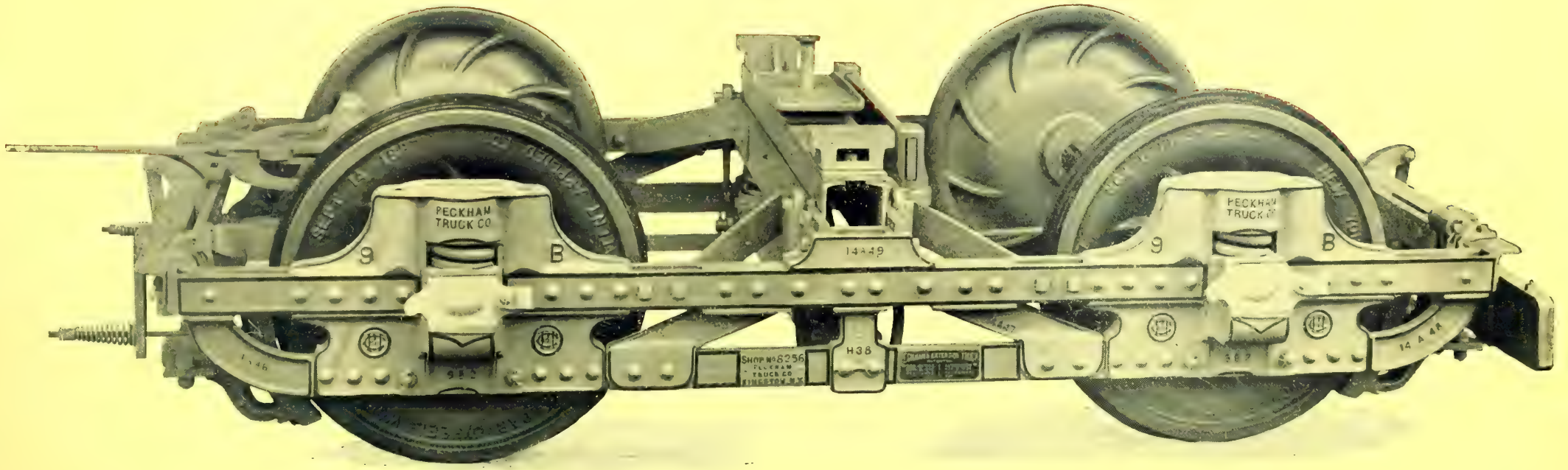
PECKHAM'S EXTRA STRONG 14 A

...SWING BOLSTER DOUBLE TRUCK



DESIGNED EXPRESSLY FOR

Extra Heavy "High Speed" Interurban or Elevated Electric Railway Service

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....SPECIAL FEATURES....

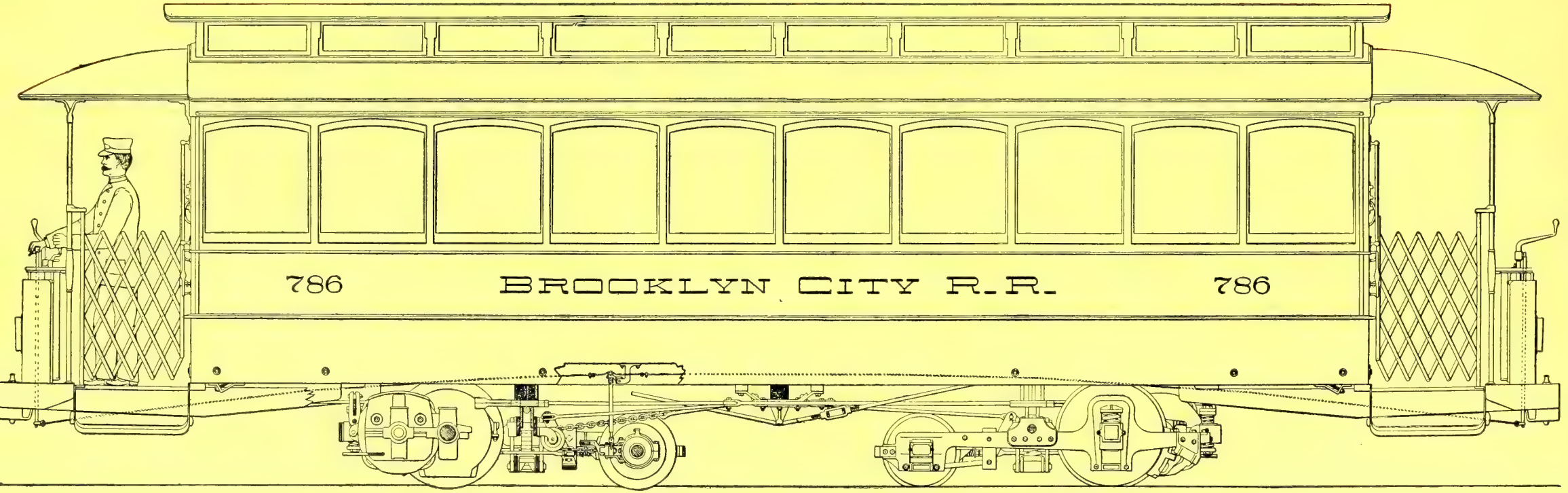
Extra Strong "Bridge Trussed" Side Frames — **Rubber Cushioned "Swing Bolster"** — **Easy Riding**

Triple Cushioned — **Powerful Brakes** — **M. C. B. Journal Boxes**

THE PRICE—

"FRICTION" POWER BRAKE

DESIGNED ESPECIALLY FOR CITY AND SUBURBAN ELECTRIC CARS.



AS APPLIED TO DOUBLE TRUCK CARS.

The Quickest Acting, Simplest, Most Efficient and Economical Power Brake in Use.

WILL stop a car in less distance than any other power Brake, and cost **75 per cent. less** for power and maintenance.
As compared with hand Brake, will stop a car before the hand Brake can be applied.
Power derived from Momentum of Car. No Gears or Pumps to get out of order. Can be operated and maintained by ordinary Motorman, skilled Mechanic not required.
Under perfect control of Motorman. Flat wheels prevented. Thoroughly tested and perfected. In use on over twenty Railways. Trial Brakes furnished subject to approval. **Satisfaction Guaranteed.**

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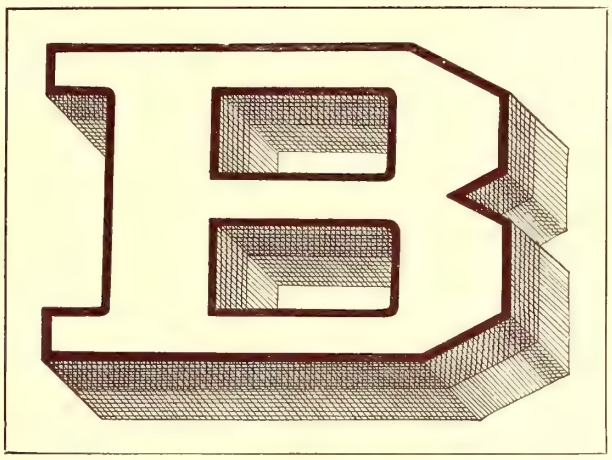
NEW WORKS OF THE PECKHAM MANUFACTURING CO.
KINGSTON, NEW YORK.



ARTICLE No. 5. . . .

Street car builders and street car companies are alike interested in the best and cheapest method by which to letter their cars. Street car builders take great pride in the appearance of their cars when they are ready for delivery to their customers, and street car companies are always anxious to have their cars looking respectable, not only as regards the scroll work and striping features, but their lettering as well. Whenever a street car company has anywhere from one to one hundred cars to overhaul, to repaint and reletter, the first thing they do is to look around for a first-class man who can apply lettering in a neat and artistic manner. Such help is in great demand, and consequently high priced. We are therefore filling a long felt want with our new transfer letters, which are fresh from the press, and made up after the very latest fashion. The accompanying cut represents a five-inch letter, which we offer to the trade in any quantity which they might see fit to buy, or in single letters. The face of the letter is in aluminum, and the shading is in gray, browns and black, a most beautiful combination. We have figures to match and are prepared to fill orders promptly. It will only cost you a few cents to experiment, and if you are not thoroughly convinced that it is a good thing, we would advise you to order a sample set, enough for one car, and see for yourselves wherein we effect a saving, and wherein you obtain a better job than by hand work. Write for samples and prices on letters, scrolls, corner ornaments, warning signs, etc., etc.

THE MEYERCORD COMPANY, INC.,

OFFICE:
Chamber of Commerce Building
CHICAGO, ILL.

AMERICAN MANUFACTURERS.
Guaranteed Decalcomania Manufacturers.

FACTORY:
CHICAGO.

CAR BODIES.
RAILS—NEW AND SECOND HAND.

A. P. EMMONS
620 Atlantic Avenue
BOSTON, MASS.

Dayton & Western Ry.
Detroit & Pontiac Ry.
Detroit, Rochester, Rome & Lake Orion Ry.
Rapid Railway System.
Detroit & Northwestern Ry.
Lorain & Elyria Ry.
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Tiffin, Fostoria & Eastern Ry.

IT IS BUT FOUR OR FIVE YEARS SINCE we began building complete car bodies. The accompanying is a partial list of roads that we have supplied with single and double truck car bodies.

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Cleveland City Ry.
Cleveland Electric Ry.
Alliance Street Ry.
Akron Street Ry.
Dayton & Xenia Ry.
Columbus Central Ry
Nassau Ry.

FOR PRICES AND PHOTOS OF CARS WRITE

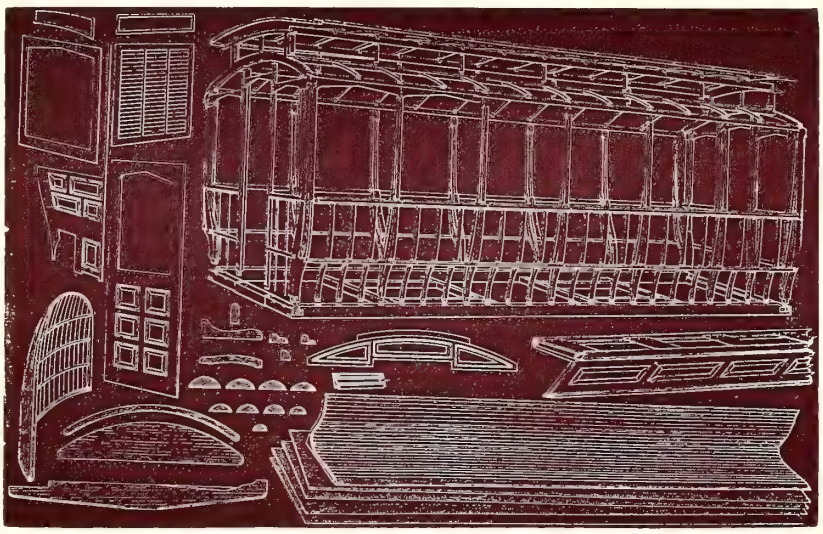
G. C. KUHLMAN CO., CLEVELAND, O., U. S. A.

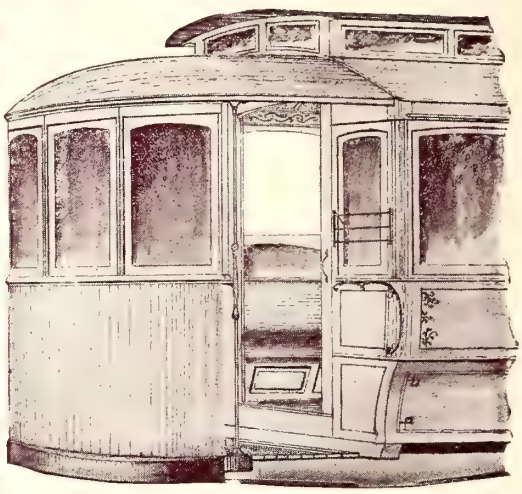
J. P. SJOBERG & CO.

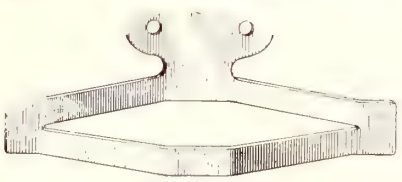
145-147 ELEVENTH AVENUE
... NEW YORK ...

MANUFACTURERS OF STREET CAR WOOD WORK

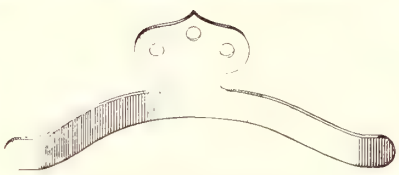
For Repairs, Rebuilding and for Stationary Vestibules. Also Portable Vestibule Fronts Complete







The most popular Car Sash and Blind Spring on the market



Single Sash Blind Spring.

The above cut illustrates a vestibule front attached to top of dash board and connected to the bonnet of the car in a practical manner. About fifteen hundred now in use.

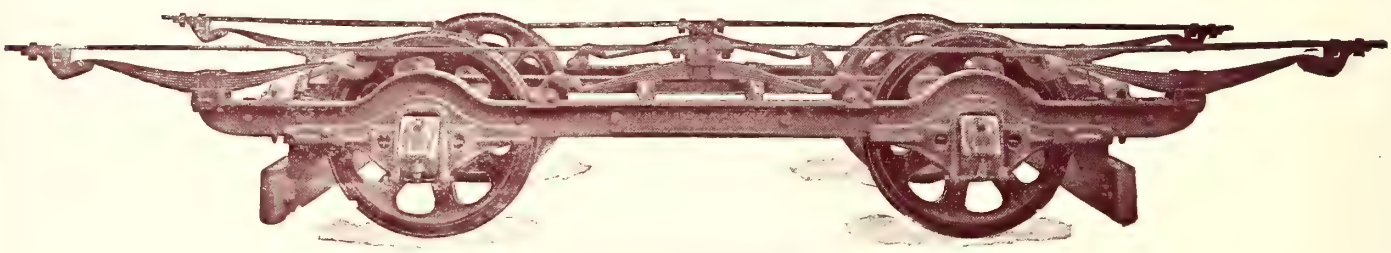
W. S. G. BAKER, *President and Treasurer.*

Cable Address, "CARWHEEL, BALTIMORE."
Western Union, Lieber's & A B C Code, 4th Edition.

J. PAUL BAKER, *Secretary.*

THE BALTIMORE CAR WHEEL CO.

BALTIMORE, MD., U. S. A.



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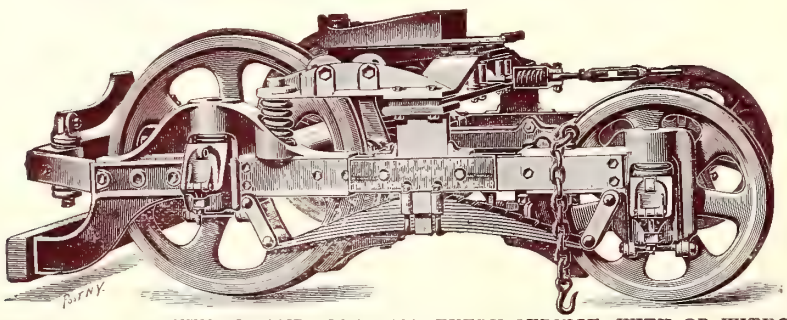
THE LORD BALTIMORE

4-WHEEL, BOGIE AND MAXIMUM TRACTION

ELECTRIC CAR TRUCKS



CHILLED WHEELS OF ALL PATTERNS AND SIZES FOR EVERY SERVICE, WITH OR WITHOUT AXLES.

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MACARTNEY, McELROY & CO., LTD. 53 VICTORIA STREET, WESTMINSTER, LONDON

McGUIRE MFG. CO.

Manufacturers of

Electric Trucks Single and Double for Every Condition of Service

Electric Locomotives

Electric Snow Sweepers

Electric Snow Plows

Royal Flush Fenders

COLUMBIA CAR HEATERS,
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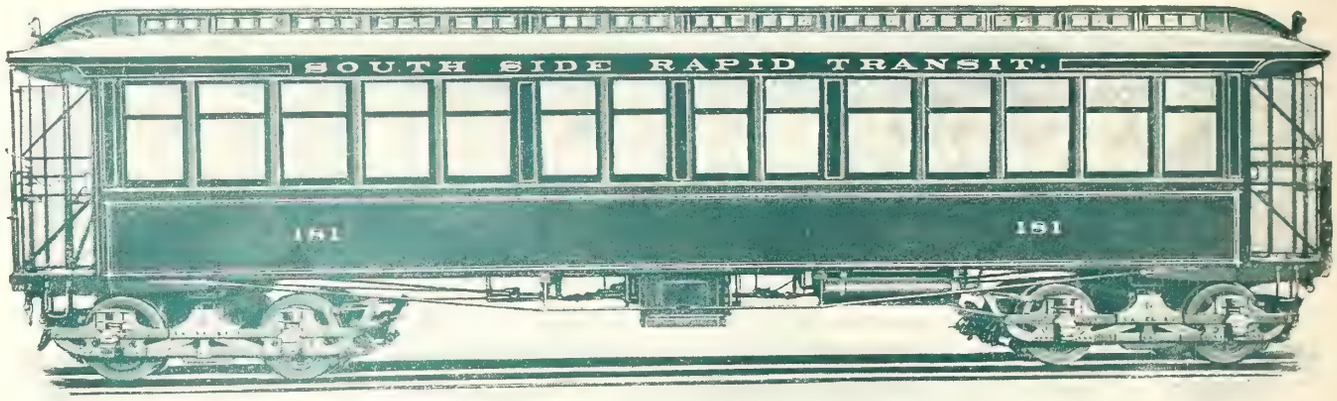
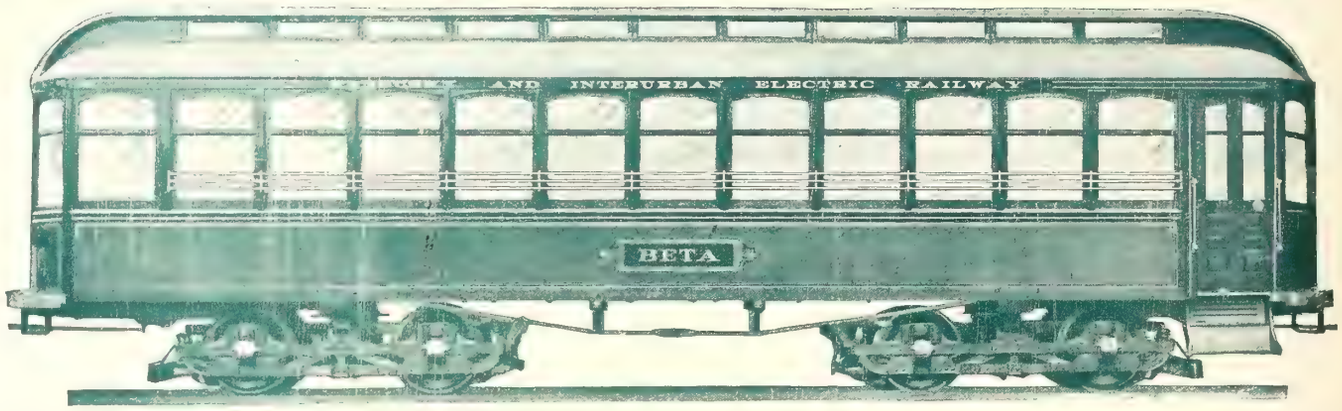
SEND FOR CUTS AND BLUE PRINTS

JEWETT CARS.


SOUTH SIDE RAPID TRANSIT.
181
181

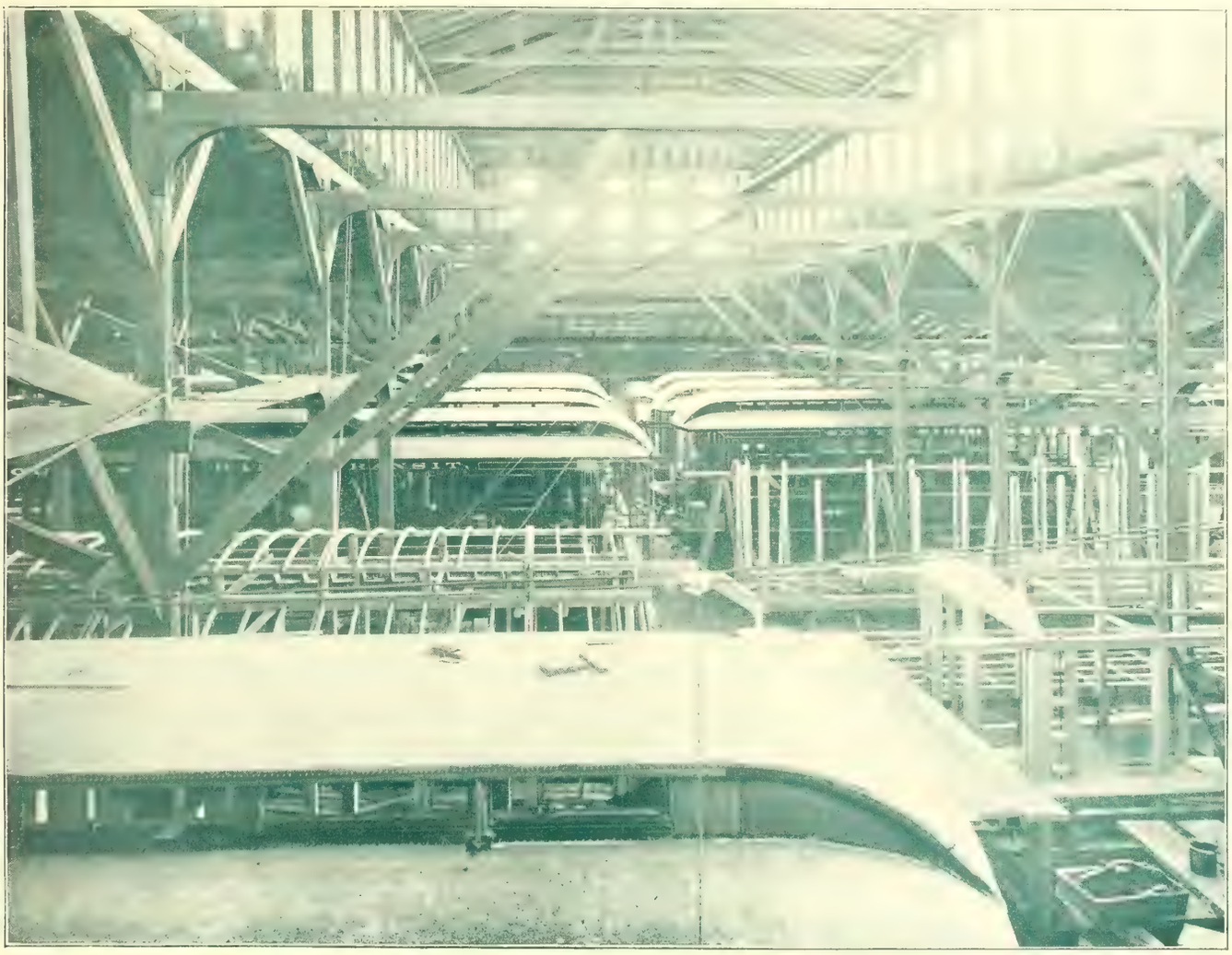

AND INTERURBAN ELECTRIC RAILWAY
BETA

THE CLEVELAND AND EASTERN RAILWAY COMPANY

418 WOODLAND, PEARL & LORAIN ST'S. 418
CLEVELAND CITY RAILWAY CO.

OUR NEW FACTORY

covers nearly ten acres, and is one of the largest in this country for the manufacture of street cars. We have had years of experience in building steam coaches; we are giving our customers the benefit of this experience by using standard coach construction in our elevated and suburban cars.



SOUTH SIDE ELEVATED R. R. (CHICAGO) CARS UNDER CONSTRUCTION IN ONE OF OUR ERECTING SHOPS.

SOME OF THE ROADS USING JEWETT CARS:

Beaver Valley Traction Co., Beaver Falls, Pa.
Cleveland City Railway Co., Cleveland, Ohio.
Cleveland & Eastern Railway Co., Cleveland, Ohio.
Cleveland Elyria & Western Railway Co., Cleveland, Ohio.
Cincinnati, Lawrenceburg & Aurora R'y Co., Cincinnati, Ohio.
Charleston Traction Co., Charleston, West Va.
Indianapolis & Greenfield Rapid Transit Co., Greenfield, Ind.
Mahoning Valley Railway Co., Youngstown, Ohio.
Meadville Traction Co., Meadville, Pa.
Moundsville, Benwood & Wheeling R. R. Co., Wheeling, W.Va.
Newark Railway Co., Newark, Ohio.
Newark & Grandville Electric Railway Co., Newark, Ohio.
Parkersburg Gas Light & R. R. Co., Parkersburg, W. Va.
Sandusky & Interurban Railway Co., Sandusky, Ohio.
South Side Elevated R. R. Co., Chicago, Ill.
South Chicago City Railway Co., Chicago, Ill.
Stubenville, Mingo & Ohio Valley R'y Co., Stubenville, Ohio.
St. Louis, Belleville & Suburban Railway Co., Belleville, Ill.
Waupaca Electric Light & R. R Co., Waupaca, Wis.
Wheeling Railway Co., Wheeling, West Va.
Wheeling & Elm Grove Railway Co., Wheeling, West Va.
Wichita Railway Co., Wichita, Kan.
Erie Transportation Co., Erie, Pa.

Our cars are now running on the above roads. Will also have them running shortly on the following:

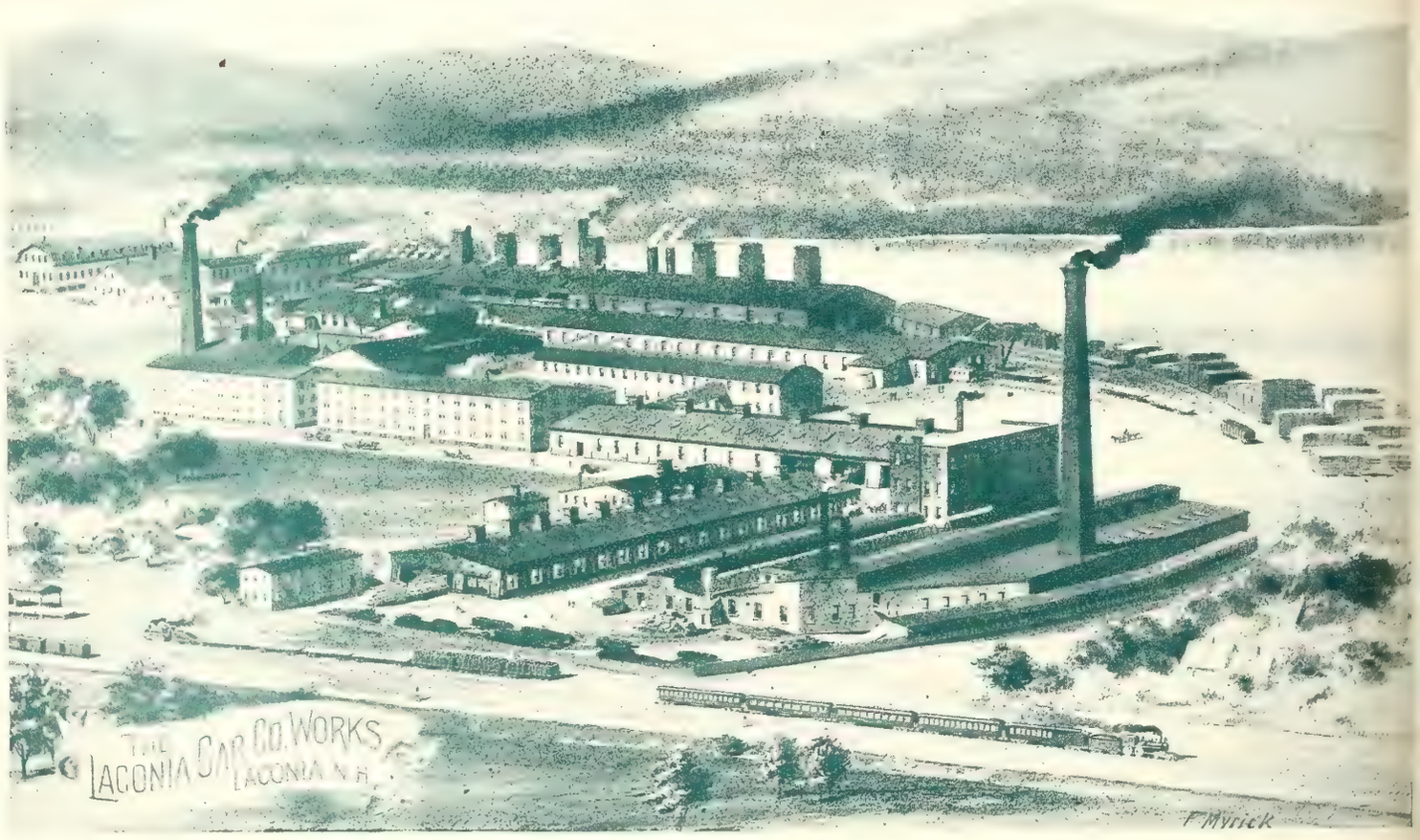
Buffalo, Hamburg & Aurora Railway Co., Buffalo, N. Y.
Dennison & Sherman Electric Railway, Dennison, Texas.
Holland & Lake Michigan Railway Co., Holland, Mich.
Toledo & Monroe Electric Railway Co., Monroe, Mich.

The Jewett Car Company, Newark, Ohio, U. S. A.

THE LACONIA CAR

FRANK JONES, President
E. H. GILMAN, Treas. and Manager

50 STATE STREET

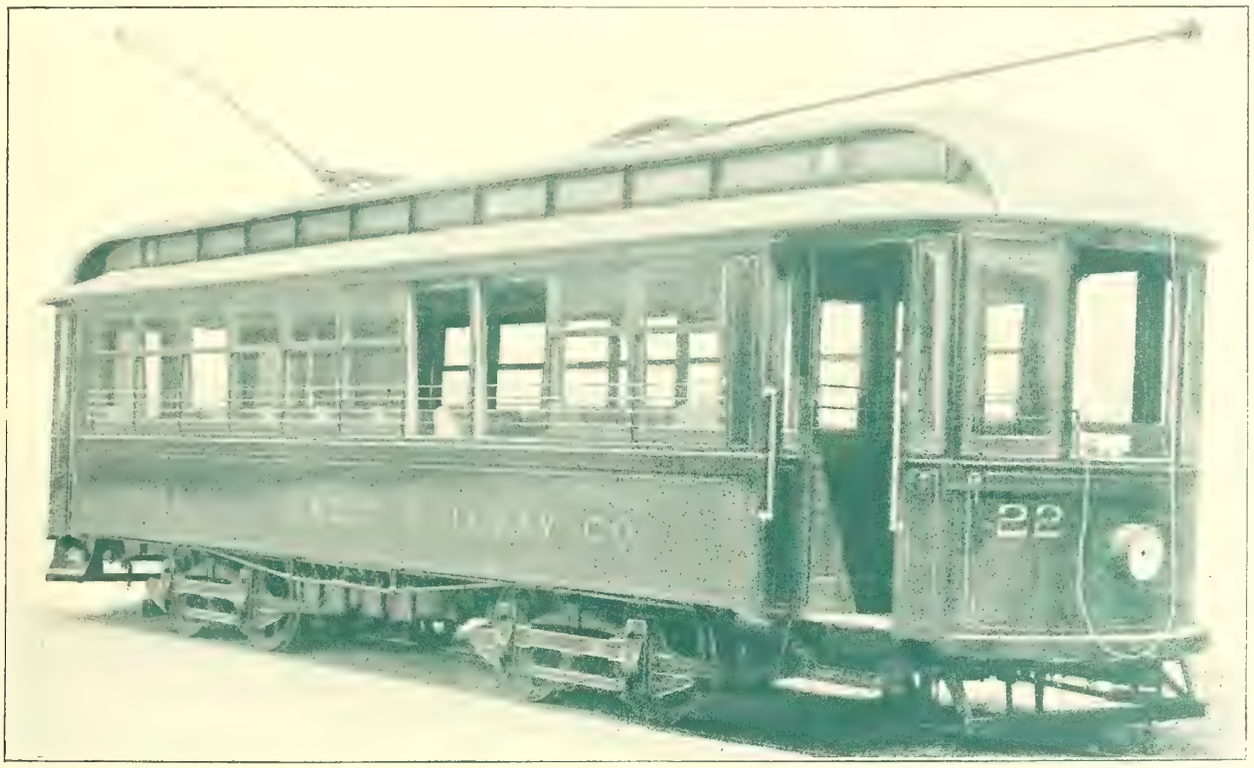


THE LARGEST AND MOST COMPLETE CAR AND TRUCK MANUFACTURING PLANT IN NEW ENGLAND

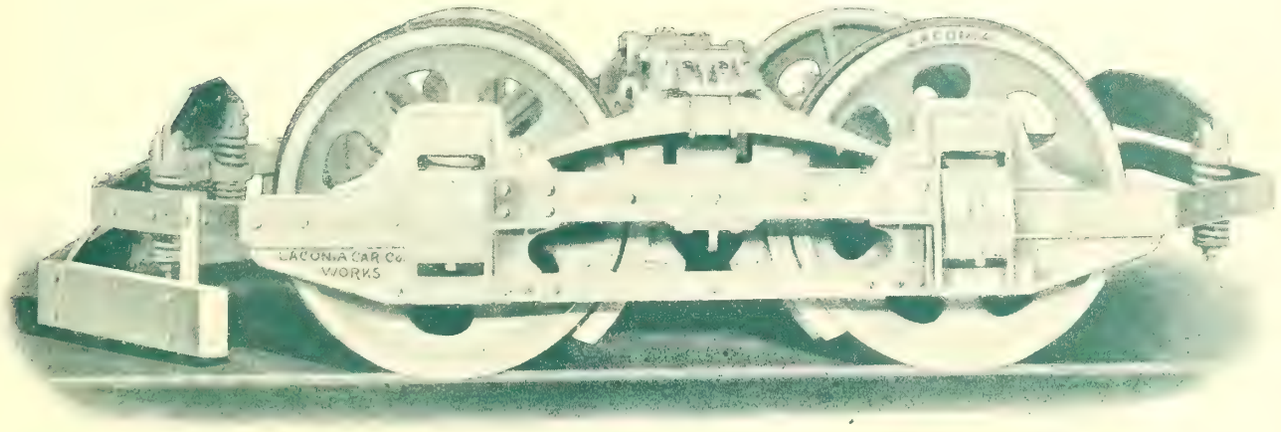
COMPANY WORKS

BOSTON, MASS.

WORKS:
LACONIA, N. H.



BUILDERS OF ELECTRIC CARS



AND ELECTRIC TRUCKS

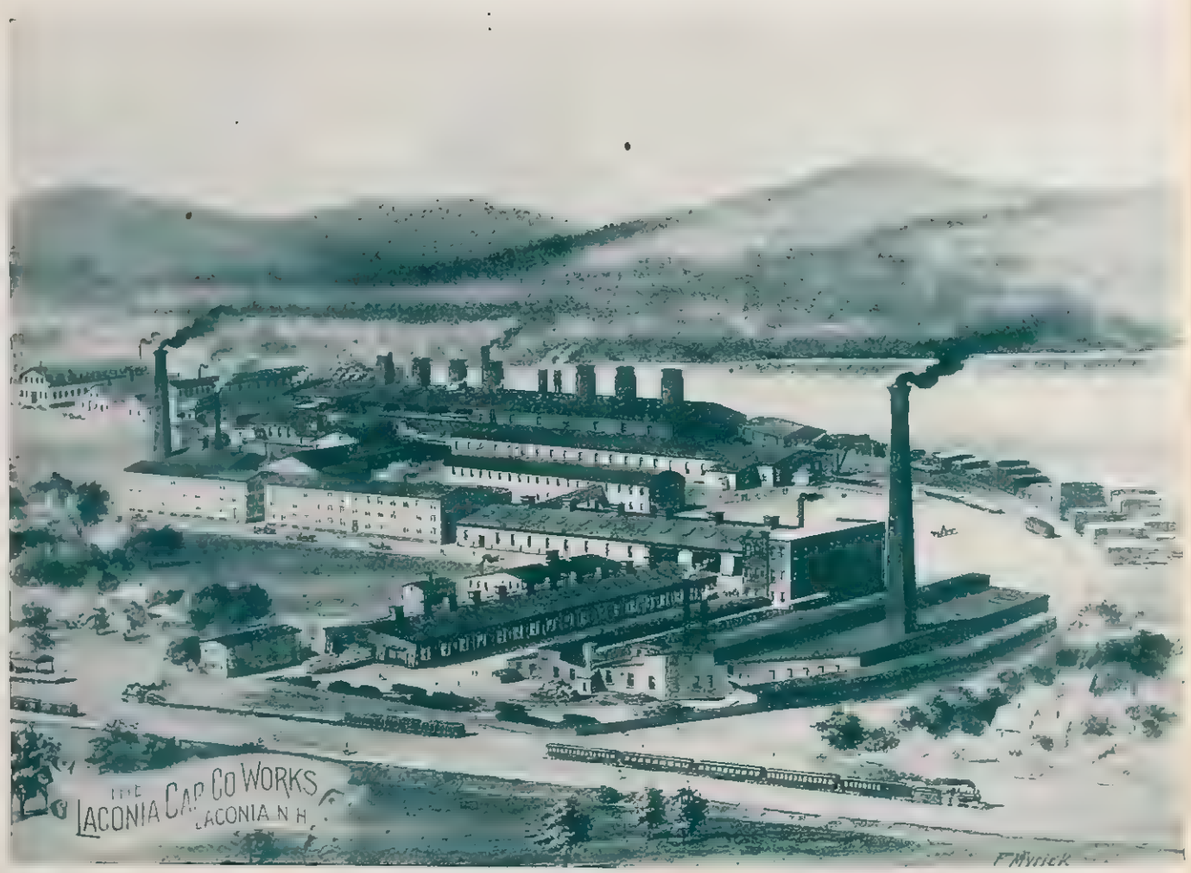
MALLEABLE IRON CASTINGS FOR ELECTRICAL WORK

THE LACONIA CAR COMPANY WORKS

FRANK JONES, President
E. H. GILMAN, Treas. and Manager

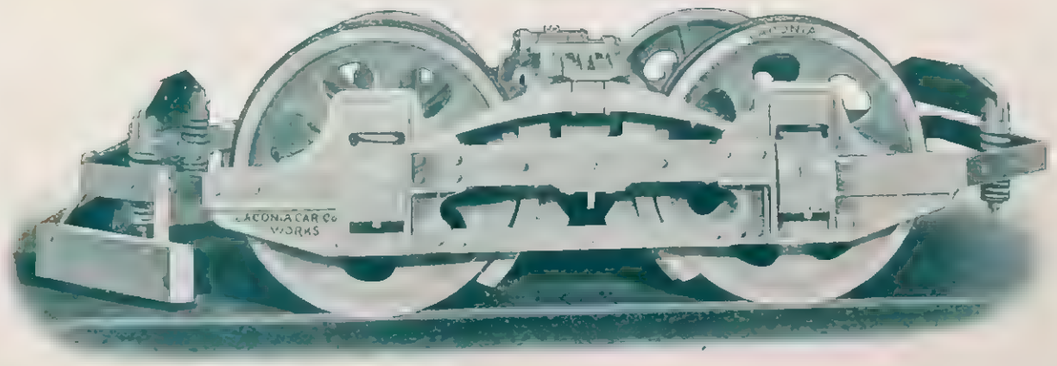
50 STATE STREET BOSTON, MASS.

WORKS:
LACONIA, N. H.



THE LARGEST AND MOST COMPLETE CAR AND TRUCK MANUFACTURING PLANT IN NEW ENGLAND

BUILDERS OF ELECTRIC CARS

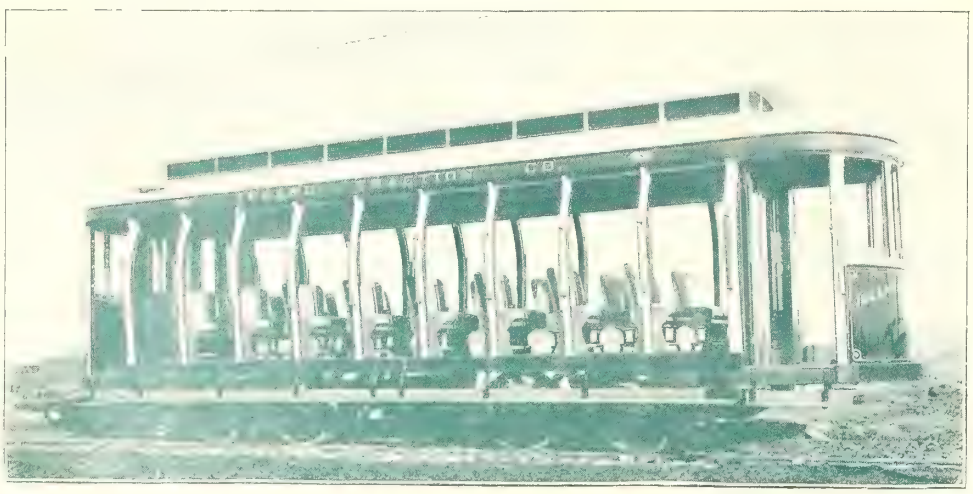


AND ELECTRIC TRUCKS

MALLEABLE IRON CASTINGS FOR ELECTRICAL WORK

THE DUPLEX CAR

Is adapted to both Summer and Winter use, and can be changed from a closed to an open car, or vice versa, wholly or partially, in five minutes' time

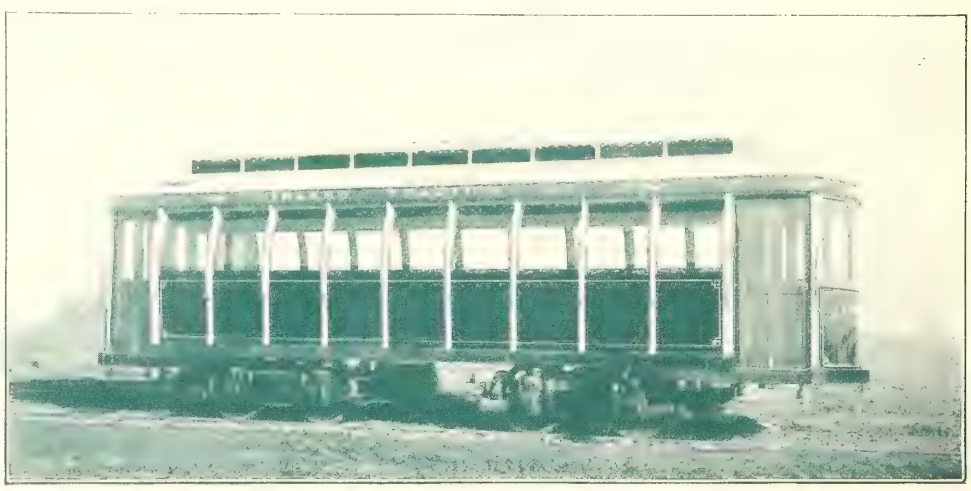


DUPLEX CAR AS AN OPEN CAR

Takes the place of double equipment.

Strongest and most durable car built. This car is in use or building for a number of roads in this and other countries : : : : : :

Practically two cars at the cost of one.



DUPLEX CAR AS A CLOSED CAR

...Prices and Specifications furnished on application...

THE DUPLEX CAR CO.

Postal Telegraph Building *253 BROADWAY, NEW YORK*

The recently organized

JOHN STEPHENSON CO.

has purchased the plant, materials, designs, name and good will of the late John Stephenson Co., Limited, and has commenced operating its New Works, located at Elizabeth, New Jersey, with

Peter M. Kling as General Manager.

This factory is the most modern and the best equipped and located car building plant in existence. The Company has on hand a large stock of carefully selected and well-seasoned lumber, and is ready to take orders for Electric Cars for early delivery. Correspondence solicited.

New York Office: 16-18 Exchange Place

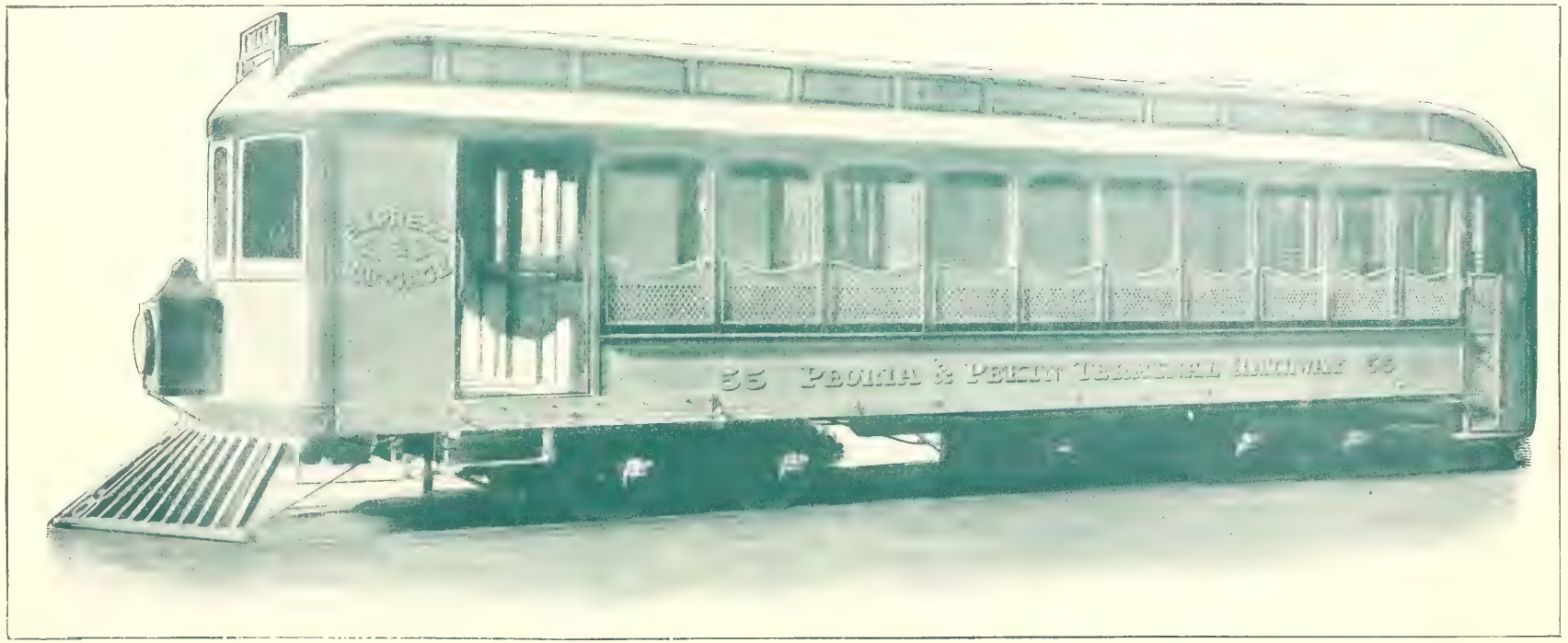
Factory and Office: Elizabeth, N. J.

AMERICAN CAR CO.

St. Louis, Mo.

WM. SUTTON, President
EMIL ALEXANDER, Secretary

EASTERN AGENT
EDWARD J. LAWLESS
115 Broadway, New York



..Street Cars and Trucks..

WRITE FOR CATALOGUE

For all kinds of Motive Power

J. G. BRILL COMPANY
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ONE FOR BRILL CONVERTIBLE CAR. ONE FOR BRILL SYSTEM OF ELECTRIC TRUCKS

J. G. BRILL COMPANY
17 Victoria Street
LONDON, S.W., ENG.

Telegraphic Address:
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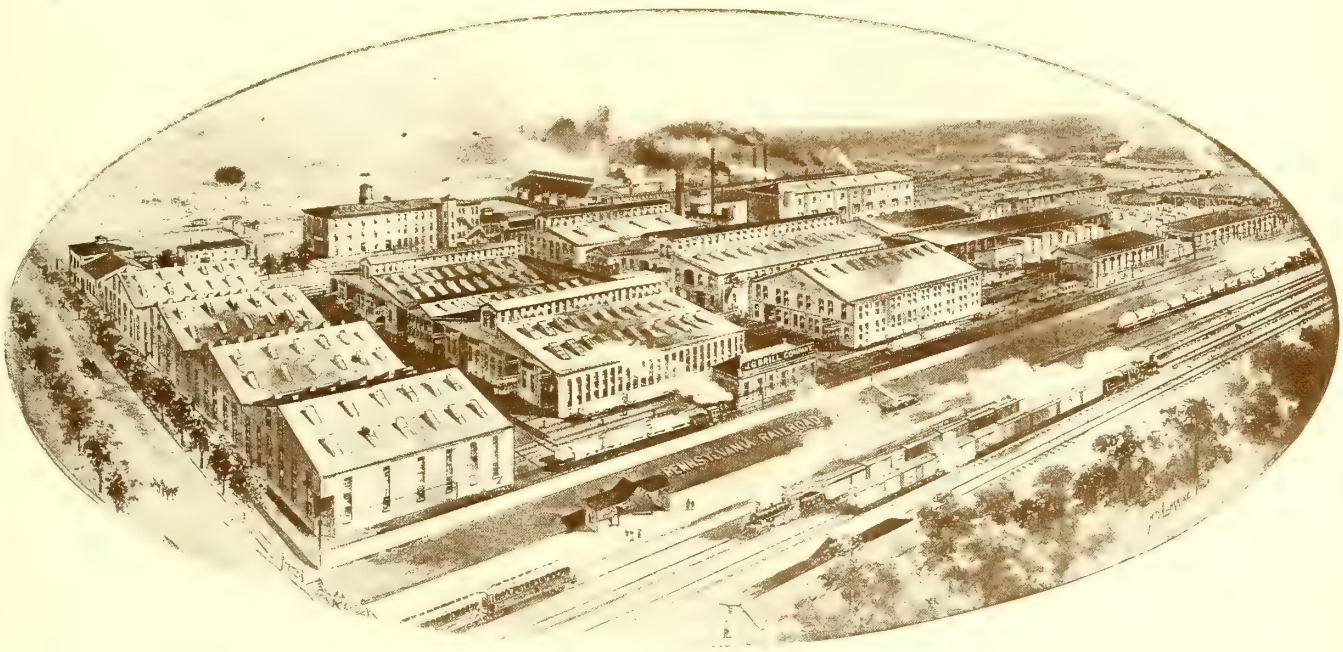
...STREET RAILWAY ROLLING STOCK...

Electric Cars and Trucks
Car and Truck Parts
Snow Plows
Sweepers
Sprinklers
Track Scrapers
Electric Locomotives
Electric Cranes
Wheels
Axles



THE Works of the J. G. BRILL COMPANY are the largest in the world exclusively devoted to the manufacture of Street Railway Cars. They are located at the junction of two trunk railway lines and at tide water, insuring prompt delivery to ocean transportation lines. They cover eighteen and one-half acres, and have five miles of railway tracks within the grounds. Capacity, 2000 cars and 9000 trucks per year.

We can furnish at short notice parts required for the repair of any cars or trucks manufactured by us. We also supply wheels and axles ready for service.

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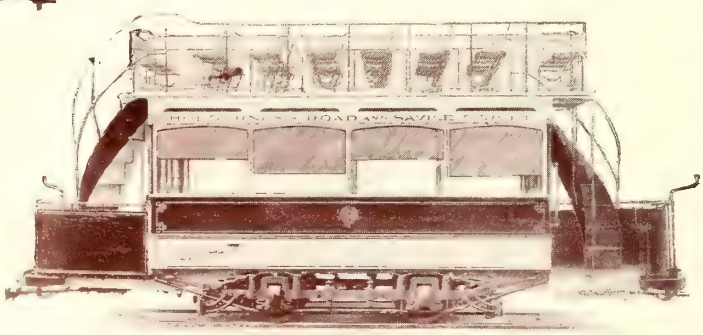
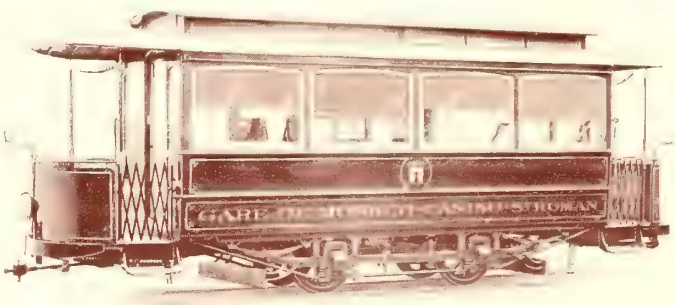
Cars of Popular Foreign Types

BUILT UPON OUR "KNOCK DOWN" SYSTEM FOR EXPORT

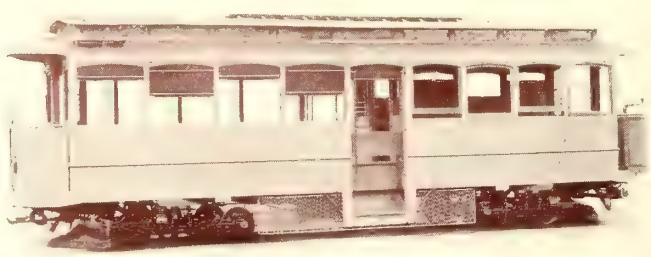
Eighteen foot car, built for Lyons, France. Center aisles; cross seats; two compartments, first and second class. Mounted on Brill No. 21 E trucks.



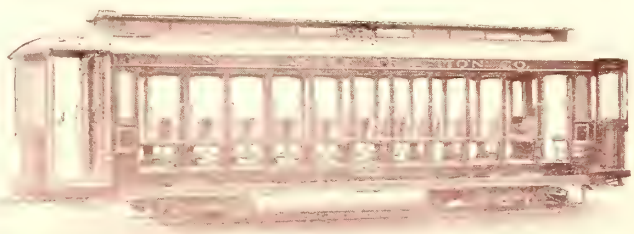
Sixteen foot Double Deck Car, for the Hull Electric Company, of England. With garden seats on upper deck. Built with or without canopy. Mounted on Brill No. 21 E truck.



Nineteen foot closed car, for Monte Carlo, Monaco. Metre gauge. First and second class compartments. Mounted on Brill No. 21 E truck.



Twenty-nine foot Center Vestibule Car, built for the Liverpool Tramways Company. Mounted on Maximum Traction Trucks.



Brill's Convertible Car, shown open. Can be closed in a few minutes. Can be built complete to take apart in sections like any of our other types.

J. G. BRILL COMPANY
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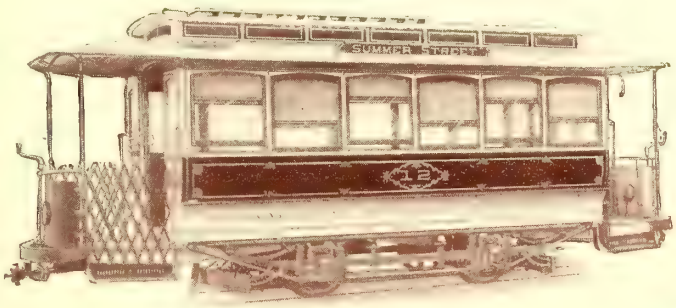
Standard American Types of Electric Cars

They meet all the Requirements of City and Suburban and Interurban Service



Standard Twenty Foot Closed or Box Car

MOUNTED ON BRILL No. 21 E TRUCK

Vestibuled Car

For the PENNSYLVANIA TRACTION CO.

25 foot Closed Car with Longitudinal Seats.
Vestibule Ends. Folding Doors.

MOUNTED ON EUREKA MAXIMUM TRACTION TRUCKS

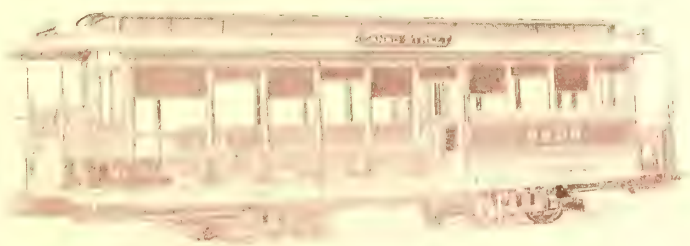
Express, Baggage and Passenger Car Combined

MOUNTED ON BRILL No. 21 E TRUCK.

Eight Wheel Car

For High Speed Interurban Service

MOUNTED ON BRILL No. 27 "PERFECT" TRUCK



Metropolitan Combination Car

California Type

Popular Type of Car for all the year round

MOUNTED ON EUREKA MAXIMUM TRACTION TRUCKS

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Snow Plows. Snow Sweepers. Track Scrapers.

COMBINATION PLOW, LOCOMOTIVE AND CONSTRUCTION CAR

COMBINATION PLOW

Combined Snow Plow and Construction Car. Strong enough for the heaviest work. With four motors, may be used as an electric locomotive when stripped for summer. As convenient as any construction car. Its great adhesion and high speed makes it valuable as an electric locomotive. We build single and double plows with movable wings. Plows of all standard types. Nose and Shear Plows.

SNOW SWEEPER

Two motors for propulsion; one for the brooms. Independent adjustment for each end of each broom. On Radial guides. Canvas wings prevent snow from flying. Drop forged sprocket chains. Complete housing and protection of men. We construct our brooms with a greater quantity of cane than usual. It is evenly distributed over the whole surface. The brooms are more durable and sweep cleaner than those of the ordinary pattern. Track scrapers of all kinds. These sufficient in many snow storms to do away with power sweepers.

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LONDON, S. W., ENG.

Telegraphic Address:
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OUR NEW CONVERTIBLE CAR

is the result of twenty-five years of experimenting. It combines all the desirable features of both open and closed types, and at the same time avoids the errors of construction and design which have spoiled other convertible cars.

AS A SUMMER CAR.

The general appearance the same as that of an ordinary open car.

The change from open to closed, or vice versa, according to the conditions of the weather, can be made without delay or expense and without sacrificing the comfort of the passengers. But five minutes' time needed for the change, which can be effected while the car is in motion.

AS A WINTER CAR.

Attractive in appearance and as warm and weatherproof as an ordinary closed car.

The construction is such as to make the car much stronger than those of the ordinary type. Equipped with these cars a road needs but half the ordinary car storage space. A saving of capital and labor and insurance, to say nothing of the cost of equipments for all seasons.

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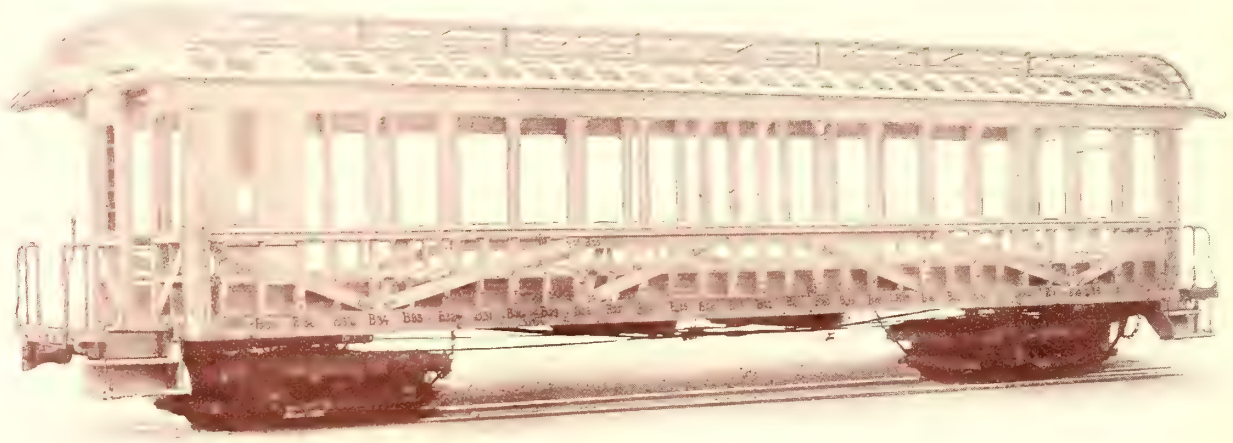
CARS FOR EXPORT.

After years of study and experiment, we have devised and perfected a "knock down" system of constructing cars for export which enables us to offer

CARS WITH TRUCKS AT LOW PRICES.



SKELETON OF "KNOCK DOWN" CAR.

We build the cars complete in such a way that they can be taken apart and the sections very compactly boxed.

They are so designed that, although they pack in the smallest possible space, they are, when re-erected, as strong and durable as those which are shipped whole.

Skilled labor is not necessary for erection.

The work can be well done by ordinary mechanics when guided by the complete blue prints which we furnish.

All parts lettered and numbered in such a way that mistakes are impossible.

We also furnish sectional cars in the white, primed but not painted.

J. G. BRILL COMPANY
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U. S. A.

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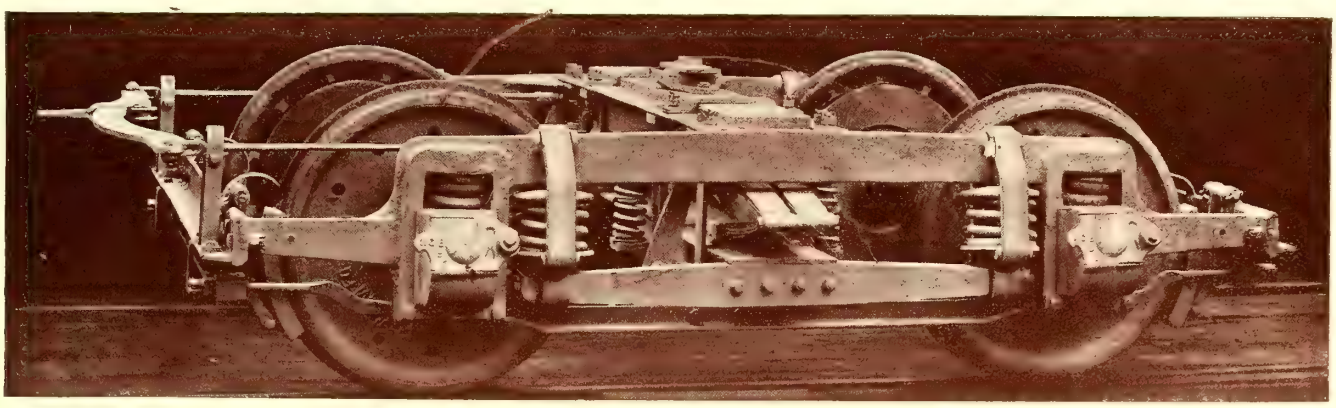
OUR No. 27 TRUCK.

THE "PERFECT" PASSENGER TRUCK.

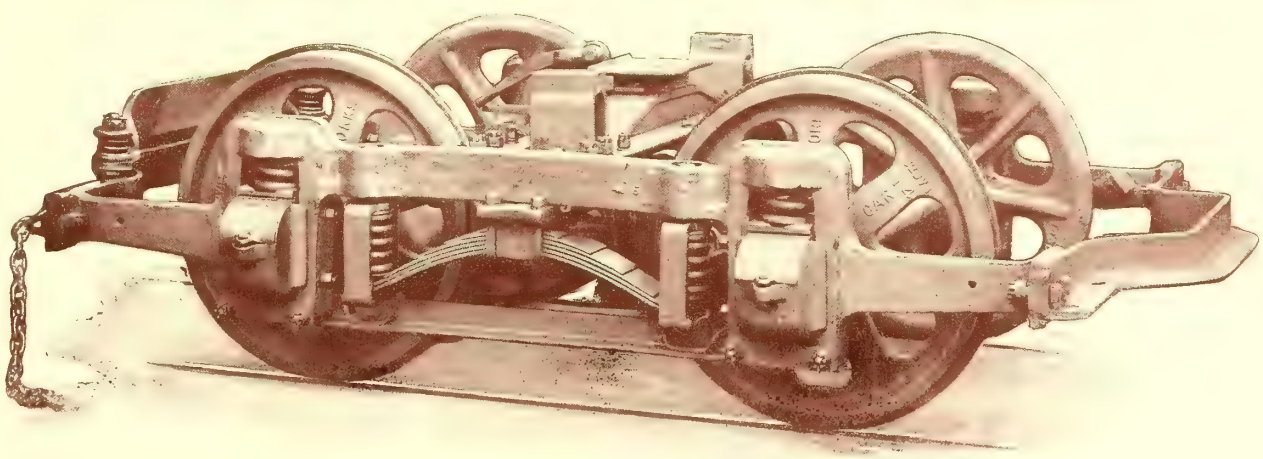
Specially adapted for fast heavy service on suburban, interurban and elevated railways. Ride smoothly at any practicable speed. It is safe under conditions which would prevent the use of ordinary trucks. "It sticks to the rails." Only improvement in Railway Passenger Trucks in 28 years. Three sets of springs in series. Full equalization.



THE No. 27 TRUCK. INTENDED FOR FAST HEAVY PASSENGER SERVICE.

In successful operation on lines 40 miles in length where a schedule of 50 miles per hour is maintained.

NEVER LEAVES THE RAILS. NO TILTING UNDER BRAKES.



THE No. 27-G TRUCK. FOR FAST CITY AND SUBURBAN SERVICE (WITH ONE OR TWO MOTORS.)

The 27-G is a modification of the No. 27 for city service when one motor per truck may be desirable. It carries the car body lower than the No. 27; wheel base, 4 feet, permitting truck to radiate between the sills of a narrow car body.

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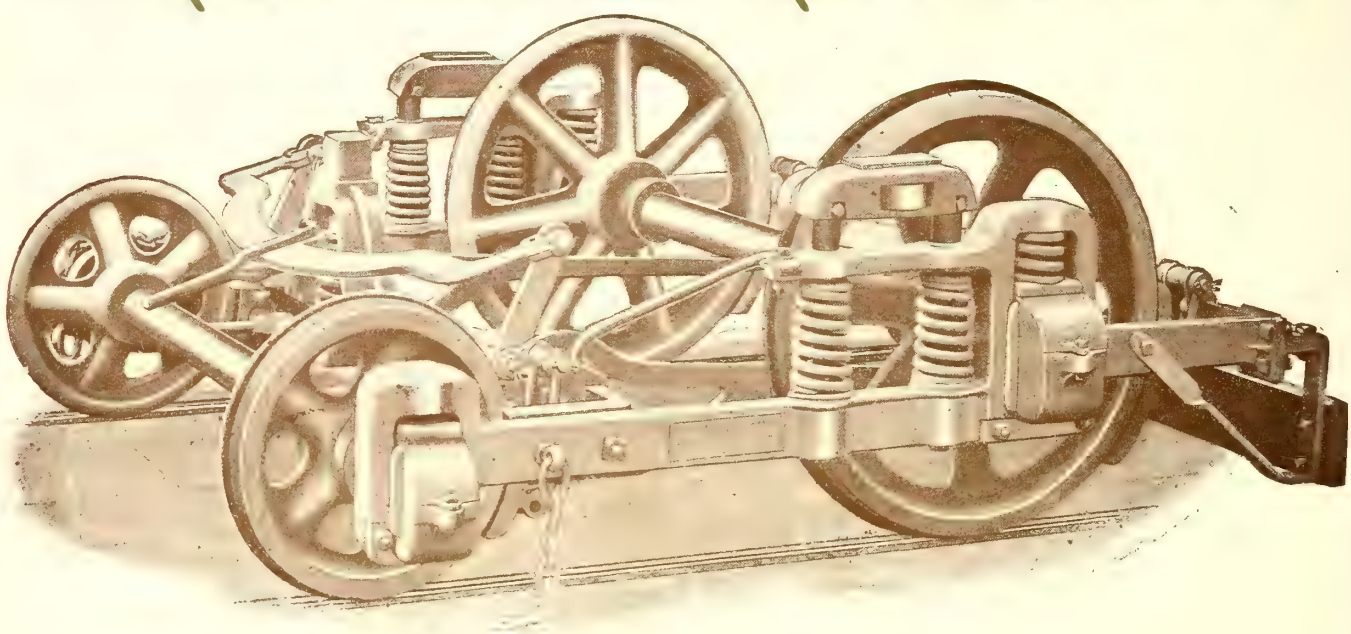
OUR

"EUREKA" MAXIMUM-TRACTION TRUCK



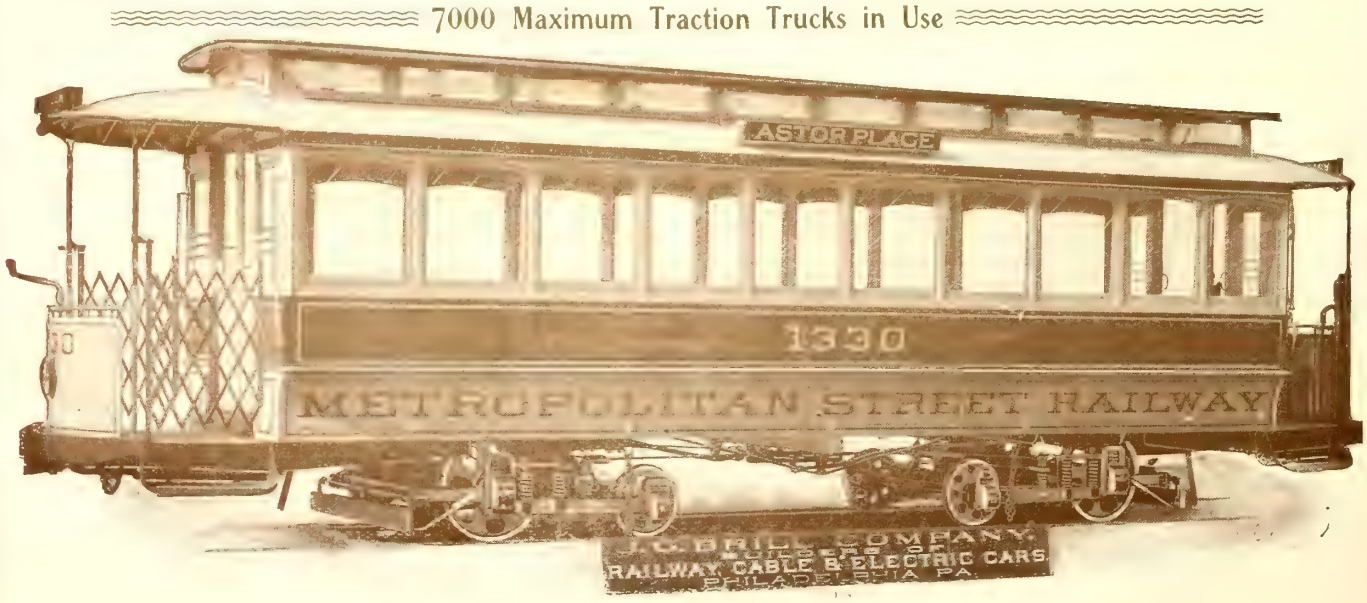
....FOR HEAVY FAST COMBINATION CITY AND SUBURBAN SERVICE....

One equipment for Summer and Winter, as these trucks can be used under open or closed cars. It is the only system of double trucks that admits of narrow cars and low steps. The only trucks that can be used where four wheel cars are spliced and lengthened to make double truck cars.

Highest tractive power possible on pivotal trucks with two motors to a car. Car body carried as low as with ordinary four wheel trucks. Large driving wheels. Steady motion of car body. Easy on the rails. Any speed up to 30 miles per hour.

Our Eureka Maximum Traction Trucks have been made standard on three of the largest Street Railways in America—The Metropolitan Road of New York City, The Brooklyn Heights Railroad of Brooklyn, and the Union Traction Company of Philadelphia.

7000 Maximum Traction Trucks in Use



Standard Car of the Metropolitan Street Railway, New York City. These cars are mounted on "Eureka" Maximum Traction Trucks.

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Two Grand Prizes at Paris 1900

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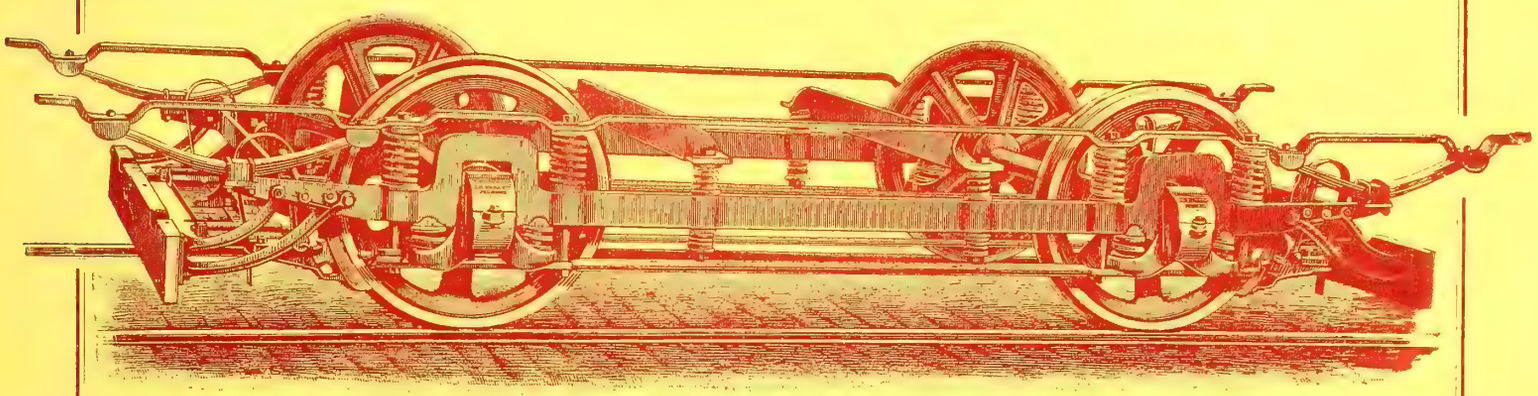
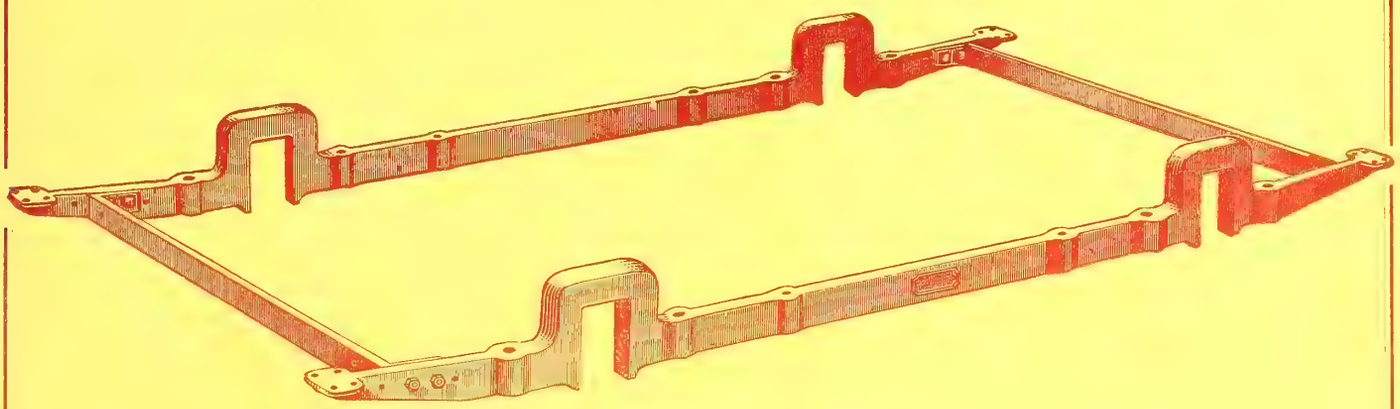
No. 21--E TRUCK



THE IDEAL NON-PIVOTAL TRUCK FOR FOUR WHEEL CARS

They do not sag at the ends. They hold the motors, gears, axles and wheels in line. They are economical in power. Easy riding. Do not pitch or gallop. Durable. Strong.



SOLID FORGED SIDE BAR AND AXLE FRAME

The solid forged frame has the maximum strength to resist strains in all directions. Never needs repairs. Side frame in one piece. Not made up with bolts or rivets.

Double journal springs at each box. Half elliptics at the ends of the frame prevent oscillation. Diagonal cross braces in centre. Heavy bar ends. Carries the car body an inch and a half lower than any other truck. The arrangement of the axle box frame is such that we can introduce the longest and strongest kind of a truss for the support of long cars.

A TYPICAL GENERAL ELECTRIC COMPANY'S RAILWAY GENERATOR

General Electric 1550 Kw., 550 Volt Generator
Operating in Kaw River Station, Kansas City.

...THE...

General Electric Company

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